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QUARTERLY

OF THE

National Fire Protection Association

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87 MILK STREET, BOSTON, MASS.

EDITED BY THE SECRETARY

National Fire Protection Association.

Executive Office, 87 Milk Street, Boston, Mass.

Active Members.

April 1, 1916.

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American Institute of Consulting Engineers
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National Association of Insurance Agents, The
National Association of Manufacturers of United States.
National Assn. of Master Gravel and Slag Roofers of America.
National Automatic Sprinkler Association.
National Board of Fire Underwriters.
National Commercial Gas Association.
National Convention of Insurance Commissioners.
National Electrical Contractors' Association.
National Electric Light Association.
National Founders' Association.
National Gas Engine Association.
National Implement and Vehicle Association.
National Lumber Manufacturers' Association.
National Paint, Oil and Varnish Association.
National Petroleum Association.
National Wholesale Druggists' Association.
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Ohio State Fire Prevention Association.
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Western Actuarial Bureau (Fire).
Western Canada Fire Underwriters' Association.
Western Factory Insurance Association.
Western Sprinklered Risk Association.
West Virginia Inspection Bureau.
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Wisconsin Inspection Bureau.
Wisconsin State Fire Prevention Association.

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Reports on fires appearing in the Quarterly are copies of or extracts from written reports forwarded to the Association. This Association, as a body, is not responsible for the statements or opinions of any of its members.

Front View of Canadian Parliament Building at Ottawa Before the Fire of February 3, 1916

Little sparks from matches,
Little piles of trash,
Will convert your premises,
Into smoke and ash.

The Quarterly

Vol. 9 April, 1916 No. 4

The Twentieth Annual Meeting. The coming twentieth annual meeting of the Association is set for May 9th, 10th and 11th in Chicago. A special notice of the date and place was issued by the Secretary on April 1st and the official program will be mailed as usual to members in advance of the meeting.

The immense volume of technical work disposed of at the meeting last year in New York will relieve our budget somewhat for Chicago and afford us a less strenuous meeting this year. Acting on this assumption the officers have accepted the gracious invitation of our Chicago member, Sears, Roebuck and Company to entertain the members at lunch and afterward make an inspection of that remarkable establishment. No official visit will be made to the Laboratories this year although members will be welcome at the big shop at any time.

The "round table" form of discussion, which gave us such an interesting session last year on high pressure systems, will be applied this year to two interesting subjects — the Fire Hazards of Schoolhouses and the Protection of High Value Districts.

Prominent public officials are to participate in the discussion of the first topic and the round table on the second is to be initiated by Albert Blauvelt and H. W. Forster taking different points of view. Several of the committee reports will be of unusual interest. The Committee on Automatic Sprinklers has been wrestling with the problem of the formation of ice in sprinkler piping of refrigerating plants; the committee on Standardization of Pipe and Pipe Fittings has a most interesting report including test records of friction losses on pipe fittings; the Committee on Uses of Wood in Building Construction will bring in a revision of the Standard on slow-burning construction; the Committee on Signaling Systems will offer a revision of the suggestions for protection against lightning and other committees will have reports which though brief will contain important and interesting items.

Free Water for Fire Protection. Chicago passed on January 10, 1916, an ordinance by which that city takes a position far in advance of many American municipalities in respect to water furnished for standpipe and automatic sprinkler equipments. Chief J. C. McDonnell of the Bureau of Fire Prevention who worked hard to secure this legislation acknowledges good help in his effort from the local officers of our active member the National Association of Building Owners and Managers. Following is the amendment: —

By-passes: Water for Fire Protection to be Furnished Free.

Be it ordained by the City Council of the City of Chicago:

SECTION 1. That Section 2778 of The Chicago Code of 1911 be and the same is hereby amended so as to read as follows:

2778. **By-passes—Indicating Device—Meters.** Water pipes, in connection with the City water mains, entering any premises and used exclusively for fire protection, shall be controlled by an indicating or proportional or other recording device or devices to indicate the flow of any water through such pipes.

Water pipes used exclusively for fire protection and connected on the street side of water meters controlling water pipes entering any premises shall be controlled by an indicating or proportional or other recording device or devices, to indicate the flow of any water through such exclusive fire protection branch water pipes.

Such indicating or proportional or other recording device or devices shall be of a type, design and size to be approved by the Commissioner of Public Works, and so constructed as to permit, in case of necessity, an uninterrupted flow of water for fire purposes. Such indicating or proportional or other recording device or devices shall be installed at the cost and expense of the owner or consumer.

There shall be no charge for City water supplied and used through such water pipes for extinguishing fires, or on account of evaporation.

Whenever such exclusive fire protection water pipes so equipped with indicating or proportional or other recording devices are cross-connected with the water piping system on the house side of a water meter controlling City water for domestic purposes, or are used to supply City water for any purposes other than for fire protection exclusively, such water pipes shall be controlled by water meters to accurately measure the flow of City water through such pipes. Such water meters shall be of a type, design and size to be approved by the Commissioner of Public Works and shall be installed at the cost and expense of the owner or consumer, and upon neglect or refusal of the owner or consumer, after ten (10) days' written notice, to provide approved water meters and indicating or proportional or other recording devices as herein required and make a sufficient deposit to reimburse the City for the expense incurred in installing the same, the Commissioner of Public Works may cause to be shut off the City water supply to such premises to enforce compliance with this ordinance and his lawful requirements thereunder.

The amount charged for water flowing through any such meter, if used for extinguishing fire, shall be decreased from and upon the books of the Bureau of Water, on proper showing of such fact.

It shall be the duty of the Chief of Fire Prevention and Public Safety to inspect or cause to be inspected at least every three months all such exclusive fire protection water piping systems, and to submit to the Commissioner of Public Works, in such a manner and form as the said Commissioner of Public Works shall prescribe, a report on the condition of such exclusive fire protection water and piping systems and detecting devices.

SECTION 2. This ordinance shall take effect and be in force from and after its passage and due publication.

Besides the free water, this ordinance renders meters unnecessary in fire protection lines, thus insuring a free water-way and a reduced expense

for the installation of automatic sprinkler systems. A singular notion in the minds of many city and private waterworks officials is that sprinkler systems waste water; they believe they should charge for water by which the sprinklers extinguish a fire, while they would get no revenue for vastly greater quantities thrown by the fire department. The sprinklers do not throw tons of water at smoke as the fire departments do; by their very nature they are more discriminating; they put the water where the fire is and nowhere else. They are water-savers, and where outside valves are provided for emergencies in which the mains may be bled, their all around desirability over any other method of fire extinguishment cannot be questioned.

* * * * *

Correcting Electrical Defects in New York. Mr. H. S. Wynkoop, electrical engineer, has sent in copies of the "order to remedy" forms now used by the New York City Department of Water Supply, Gas and Electricity in connection with electrical inspections where the equipment is found defective, also form of tag used in disconnecting and sealing a dangerous equipment. Under the new ordinance the Department is given a better authoritative status by which to handle rebellious citizens. One Michael Jacovone, of 643 W. 50th Street, Borough of Manhattan, was recently fined fifty dollars by Magistrate Noonan, sitting in the Third District Municipal Court. Jacovone's offense consisted in a failure to correct serious electrical defects existing on his premises within the time fixed by an order of the Department. This is the first conviction under the new ordinance. The Corporation Counsel has other cases in hand.

In sending in the "order to remedy" form Mr. Wynkoop writes: —

> On this form I have pasted a copy of one of our recent orders served upon the lessee of a hotel. He has been given ten days in which to comply with this order. The time allowed is evidently insufficient, but in view of the dangerous conditions we expect him to get to work at once. If he does so the time will undoubtedly be extended; but if he is indifferent we have only ten days to wait before taking him to court.
>
> Another procedure lies open to us in this case. We might serve a notice on him and disconnect the entire equipment. This is a last resort, however, as it would practically amount to shutting up the hotel, thereby inconveniencing a great number of people.

* * * * *

Closing Hazardous Buildings. For the first time in the history of New York City, two factory buildings were closed December 30, because owners refused to comply with fire regulations.

The order was signed by a supreme court justice, upon application of Fire Commissioner Adamson. Similar action is contemplated against 250 other buildings in which fire prevention orders are constantly violated.

The five-story factory building at No. 273 Canal Street, and the six-story loft and factory building at No. 49-51 Elizabeth Street, were those closed. Six hundred employes were thrown out of work by the order. Policemen were stationed at all entrances to arrest any employe who attempted to enter.

Conditions in the Elizabeth Street building were the worse of the two, Commissioner Adamson stated. In his affidavit the commissioner quoted from a recent report by Deputy Chief Langford, in which it is asserted that if fire broke out while the 100 employes were in the building not more than twenty could escape.

Five orders for correction of fire-law violations have been ignored during the past three and one-half years, the commissioner stated. The building housed paper box, leather goods, brass goods and gas fixture manufacturing firms. On the fifth floor, the commissioner declared were stored quantities of nitric, sulphuric and muriatic acids.

The Canal Street building was occupied by the Lamport Manufacturers' Supply Company. Twelve orders for fire prevention improvements had been served on the owners since last May, Commissioner Adamson asserted. When the building was last inspected 80 tons of new cotton rags were stored there. There is no automatic sprinkler system, and the fire escapes are said to be antiquated.

* * * * *

Personal Liability in New Jersey. According to Chief C. Albert Gasser of the Bureau of Combustibles, Newark, N. J., no more important fact in the local campaign to safeguard life has been developed than the recent decisions rendered in the Common Pleas Court by Judge William P. Martin and Judge Harry V. Osborne.

Lillian Feldman was sixteen years old and she lived at 257 Broome Street. She was employed as a stenographer and bookkeeper in a brick building at 17 New Jersey Railroad Avenue. The building was known to have been a hazard and the occupant had been warned. Fire destroyed the building on April 1, last, and this girl was burned to death.

Judge Osborne in his decision has awarded an indemnity of $5 a week for 300 weeks to the mother of the girl, declaring that fire must be considered as a risk incidental to employment.

Mrs. L. T. B. Pinkett, colored, was employed as a domestic by Dr. and Mrs. Joshua W. Read, who resided in the Aldine apartments at 546 Broad Street. She slept in a room on the fifth floor and was unable to escape when fire gutted the building on May 9, 1914. She was burned to death.

Judge Martin in his decision has awarded an indemnity of $4.61 a week for 300 weeks and funeral expenses to the dependents of Mrs. Pinkett. Judge Martin ruled, "The accident arose 'out of the employment' of the deceased because it was something the risk of which might have been contemplated by a reasonable person . . . ."

* * * * *

Burns Through Great Wall. The famous mine fire which has been raging now for more than 60 years and which started at Summit hill, near the spot where Phillip Ginter discovered anthracite coal in Pennsylvania in 1791, has burned through the immense concrete

wall which the Lehigh coal and navigation company sank in front of it deep down into the earth several years ago at a cost of more than $1,000,000, says a dispatch from Lansford, Pa. It is now threatening the mammoth vein in the Panther creek valley, the largest and richest vein of anthracite in the world.

The wall, which was sunk into the ground to a depth of 100 feet, was 15 feet thick, of solid concrete and experts believed it would prevent the fire from spreading any farther and eventually extinguish it. Lehigh coal and navigation company officials are putting forth every effort to prevent the fire from getting into the vast beds of anthracite in the vicinity. A large force of men are at work drilling holes deep into the earth and into these openings water and slush is being poured directly on the subterranean fire. Already this fire has destroyed millions of dollars' worth of coal while the 60-year fight to extinguish it has cost enormous sums.

* * * * *

Plumbers and Sprinkler Equipments. An interesting story is told by one of the inspectors of our active member the Factory Insurance Association of his experience at one of the factories where repairs to a sprinkler system were made by plumbers. It is as follows: —

Soon after arriving on the morning of January 10th, I called the manager, on the phone and inquired in regard to the proposed changes and was advised that the work was in progress. I reported immediately thereafter at the plant and looked over the work in the yard. The owners (probably at the suggestion of the plumbers) had revised my lay-out some and this revision detracted from this lay-out considerably because it made the system dead-ended at the very point where four main feeders were taken off. I explained my reasons for making my lay-out as it had been submitted and then orders were given to install the system as originally specified.

Next I looked over the entire equipment and found about two-thirds of the plant without protection, water having been shut off and the mains cut. I asked why I had not been notified that this work was going on, whereupon it developed that the plumber had taken it upon himself to make the changes without doing any notifying, in fact, the management did not know until this time that the protection was impaired. Wooden plugs were soon provided and steps taken to push the work through as quickly as possible. By this time it was about 10 a. m. and it was necessary to run about ten or eleven lead joints before the protection could be restored. The work dragged along throughout the day until at 5.30 p. m. there still remained four joints to be run, when suddenly it developed that the supply of lead had given out. The men doing the work, two journeymen plumbers and a helper, went out for supper and to hunt up some more lead. About 6.30 p. m. one journeyman plumber returned with the lead and with the news that there was a banquet of plumbers on the docket for the evening and that the job would be completed by him alone. Meanwhile the fire under the lead pot had gone out. The lead was placed in the pot and a new coke fire started under same, and about this time the last-mentioned plumber disappeared. Things continued along this general line until it was midnight before the lead was even melted and it was 2.30 a. m., before the remaining work was completed. The water was turned on at 2.30 a. m. and every joint as far as I could make out in the dark was leaking. The water was left on and a drain dug for the leaks.

This morning (the 11th) the plumber found that he needed one of his journeymen plumbers on some other job so he took him off. As a result the one standby spent the entire day calking the joints which were leaking and now to-night we have about half of the underground work for this risk ready for test and, without something preventing, I believe we will

be able to get this much of the work tested and the bends strapped by to-morrow night (the 12th). Meanwhile it is cold weather in these sections and it is really essential that this installation be made as soon as possible in order to prevent a freeze up.

Until this equipment has been satisfactorily completed I will remain in close touch with the situation.

The Association reports that this inspector was at this plant five consecutive days supervising work which should not have taken over one or two, and that in its records are many similar reports justifying the opinion that reliable sprinkler contractors alone should install fire protection equipments.

* * * * *

Electrical Inspection Court Decision. — The appellate division of the supreme court of New York seems to have a pretty clear conception of individual responsibility under the laws of New York for right and proper fire conditions. In reversing the ruling of the inferior court in the matter of the suit of the fire commissioner against the Greenwood Cemetery Company, reported on page 283, volume 8, of the QUARTERLY, a great public service was properly rendered the cause of fire prevention. This court in November made another reversal of the ruling of the inferior court in the case of Paul G. Tizmer versus the New York Edison Company. Tizmer sued the lighting company and recovered judgment for a large sum of money as a penalty for the lighting company's refusal to furnish electric current on demand. The suit was brought under the law which provides that gas or electric light must be furnished, upon application, to the owner or occupant of any building within 100 feet of any gas main or electric trunk line and that upon refusal to do so a penalty shall be incurred in the sum of $10.00 and the further sum of $5.00 for every day during which such refusal or neglect shall continue. The basis of the refusal of the lighting company to furnish current was the fact that Tizmer could show no certificate of approval of the New York Board of Fire Underwriters which inspected his equipment. The wiring of the building was done by Tizmer himself who was an electrical contractor. The lighting company had been notified by the Board of Underwriters that the wiring was not only in violation of the National Electrical Code but was in unsafe condition. The inferior court agreed that Tizmer was not bound to furnish the certificate of the underwriters involving a charge of $2.50 for inspection service. In rendering the decision reversing the ruling of the inferior court, Chief Justice Scott after a careful review of the laws under which the decision of the inferior court was rendered concludes as follows:

To satisfy itself of the sufficiency and safety of plaintiff's equipment defendant had undoubtedly a right to insist upon an examination of that equipment before turning on the current. This right it might properly do by its own employees, or it might appoint an agent to do it, or it might accept the result of an examination by any person in whom it had confidence. It was the party to be satisfied and it had a right to determine whose examination and approval would be satisfactory to it. It was not bound to make the examination by its own employees. It selected the Board of Fire Underwriters as the body whose examination and certificate would be satisfactory and accept-

able to it. In so doing it acted strictly within its rights, and with much good judgment, because fire is the most usual result of defective wiring, and the Fire Underwriters are the persons most interested in seeing to it that electricity is not furnished to a defective equipment. It was therefore, in our opinion, both lawful and reasonable for the defendant to refuse to furnish current without the production of a certificate from the Board of Fire Underwriters.

But, plaintiff contends, it was unreasonable to insist upon the production of this certificate, because it could not be obtained without the payment of a fee to the Board. This objection does not impress us as a serious one. If defendant had elected itself to inspect the plaintiff's equipment it would have been required to hire and pay a trained expert for that purpose, and we are aware of no Statute or rule of law which would have forbidden it to make a reasonable charge for that service. The rate which a gas or electric light company may charge for the current which it furnishes is prescribed by law, but that rate covers only the supplying of the current and does not cover the expense of a preliminary inspection for safety. The right and duty of preliminary inspection when one is dealing with so dangerous a commodity as electricity is not alone for the benefit of the Company supplying the current, but is a public duty which should not be neglected. If the Company itself could lawfully exact reasonable compensation for making a preliminary examination, the agency which it selects and relies upon to satisfy it as to the sufficiency of the equipment may likewise make such a charge, and so long as that charge is not unreasonable (and it is not claimed that it was in this case) it would be most unjust and improper to compel defendant to take the risk of supplying electrical current to an uninspected and uncertified equipment.

We are therefore of the opinion that defendant's insistence that it should be satisfied of the safety and sufficiency of plaintiff's equipment by the inspection and certificate of the Board of Fire Underwriters was reasonable, and that the fact that such a certificate could not be procured without the payment of a small and reasonable fee did not require defendant to furnish current in the absence of such a certificate. If this be so defendant was not liable for the penalties prescribed by the Statute. Other questions have been discussed at length in the briefs, but in the view we take of the case we do not find it necessary to consider them.

The judgment and order appealed from are reversed with costs and disbursements and the complaint dismissed with costs, the finding that defendant had unlawfully refused to furnish electric current to plaintiff on demand being also reversed.

* * * * *

Personal Liability in Quebec. Our Montreal member Mr. W. E. Findlay, reports a recent judgment of special interest to tenants in relation to their responsibility to landlords for damages caused by fire to dwellings. Mr. Justice Mercier in the Superior Court rendered the judgment. This condemned George B. Reynolds to recompense Ida Florence Appleton to the extent of $1,830 for loss sustained through fire at a bungalow at Lakeside several days after Mr. Reynolds had entered into residence there in the summer of 1915.

The action taken by Mrs. Appleton, the plaintiff, was based on Article 1629 of the Civil Code of the Province of Quebec, which provides:

> . . . . When loss by fire occurs in the premises leased, there is a legal presumption in favor of the lessor that it was caused by the fault of the lessee, or of the person for whom he is responsible; and unless he proves the contrary he is responsible to the lessor for such loss.

Plaintiff rented to Mr. Reynolds, the defendant, a furnished bungalow at Lakeside, for six months, dating from May 1, 1915, until October 31, following. The rent was to be $250, payable $100 down, $50 on June 1, and $50 on the first of each subsequent month to October. Defendant

took possession of the villa on or about May 1 and occupied it, with his family, until May 16-17 following, when the entire dwelling and its furniture was destroyed by fire.

Mr. Justice Mercier, in rendering judgment, said the defendant had failed to prove that the fire was not due to his fault. In fact, the proof furnished only accentuated the fact that he could not escape from the responsibility placed upon him as tenant by Article 1629 of the Civil Code. It had been proved, the judge said, that defendant had been in the habit of putting hot cinders from the fire into a wooden box placed near the trellis-work on the verandah in the rear of the house. It had been equally proved by the evidence of both plaintiff and defendant that the fire originated at this place on the verandah.

Therefore, the judge maintained the action of the plaintiff, but reduced the amount of the claim by $255, giving judgment against defendant for $1,830, with costs.

Mr. Findlay states that the Civil Code is in reality the old French law which still holds good in the Province of Quebec.

Why the Commerce Club is so Much Interested in Fire Prevention.

Commerce Club, St. Joseph, Missouri.

(Member N. F. P. A.)

Not because we are primarily interested in the insurance companies, nor because we have taken up fire prevention as a fad. *It is a clean-cut business proposition.* Insurance for the full amount of "loss" does not begin to cover the cost of fire.

Its real cost is its economic waste, throwing men out of work, accidents and loss of life, loss of industries to the city. Of this we have a recent example: The Hominy Mills burned. About fifty men were thrown out of work, and *the industry will leave the city.*

Members' Activities.

Secretary Wentworth paid a visit to Canada in January on invitation of the Commission of Conservation, sitting with that body for the purpose of assisting in working out a comprehensive plan for reducing the fire waste of the Dominion. He addressed the Commission on the 18th, was a guest of the Ottawa Fire Agents Association at luncheon at Chateau Laurier on the 19th, with John B. Laidlaw (Chairman Canadian Committee, N. F. P. A.) and spoke at the Convention of the Civic Improvement League of Canada in the railway committee room of the House of Parliament on the 20th. On January 14th, he spoke at the annual Convention of the Bricklayers', Masons' and Plasterers' International Union at Toronto, enlisting the aid of that body in the prospective extension of the fire limits of certain American cities.

* * * * *

H. W. Forster, Chairman Committee on Safety to Life, was the guest of the Insurance Institute of Hartford at the seventh annual banquet of the Institute at the Hartford Club, March 16th, speaking on "The Contribution of Fire Insurance to Safety to Life." He declared that well over a million persons injured, about one-seventh of them seriously, and about thirty thousand persons killed in industry and transportation is the annual toll in the United States.

After explaining the growth of accident prevention work in America in the last half-dozen years and the part played by the insurance companies in promoting safer conditions in industry he said: —

And now, I should like to invite your consideration to another phase of the safety problem, namely, accident prevention as an aid to preparedness. To the best of my knowledge, the very vital relation of these two subjects has not been brought out in the numerous discussions of preparedness in Congress and elsewhere.

It is the claim of the advocates of preparedness that an important nation ready for war inspires such respect that most causes of war automatically dissolve themselves in diplomatic communications. Preparedness is therefore said to prevent war. It is obvious to all of us, more so than the first premise, that a war once begun, the thoroughly prepared nation has a far better chance than the unprepared one of terminating it speedily and successfully.

It is unquestionably something more than a coincidence that the German nation, which originated systematic accident prevention, and has of all nations most successfully carried it forward, has given in this war a demonstration of national efficiency without a parallel in history. A nation that looks after its peoples health, safety, and education carefully, can logically be expected to put large and physically fit armies into the field, armies so completely equipped that duplicate suspender buttons adorn trooper's trousers!

I have tried to impress you with the magnitude of our accidental deaths and injuries in times of peace. Let me give you a few more examples.

2,667,000 men fought for the North in the Civil War. Thirteen and one-half percent, or 360,000, died of wounds and disease. The deaths per year averaged 90,000. By industrial accidents in our country 90,000 able bodied men are killed every four years.

Gettysburg has gone down in history as one of the greatest battles. 155,000 men were engaged. 5,600 were killed. Supposedly peaceful pursuits account for four times as many per year.

An army of about 500,000 men steadily at war, year in and year out, would have a death and injury toll about equal to our industrial and transportation ones.

Such has been our record. But the Nation is shaking off the idea that such losses are unavoidable. Based on what has already been done in the man-saving field, it is certain that there can be prevented annually the killing and serious injuring of 100,000 men of military age. The cumulative effect of such safety work will make this saving 1,000,000 men in 20 years.

Preparedness for war demands that we conserve these men for the safety of the nation.

Preparedness for peace demands that we conserve them for the pursuits of industry.

Humanity demands that we conserve them for the pursuit of happiness.

A special feature of the banquet was the moving picture reel that was shown for the first time in Hartford displaying actual inspections as made in the Underwriters' Laboratories in Chicago.

* * * * *

Fire Prevention Commissioner John A. O'Keefe, of Boston, has worked out an ingenious plan to stimulate fire prevention activity in the cities under his jurisdiction. He gives monthly to the newspapers a statement of the relative number of alarms, the alarms per 10,000 of population and the standing of the cities and towns based on the alarms per 10,000.

This statement makes clear the relative housekeeping shortcomings of the cities on the list. As a result of this publicity the cities with the unfavorable ratings are striving to reduce their monthly record of alarms per capita by initiating fire department inspections and cleaning up generally.

* * * * *

Beside his work in Canada and his two annual March lectures before the students of the School of Business Administration at Harvard College, Secretary Wentworth addressed the following organizations during the quarter: Providence Association of Mechanical Engineers; Insurance Institute of Hartford; Underwriters' Laboratories' Staff meeting; Insurance Society of Cleveland; Society Advocating Fire Elimination, Cleveland; New Haven Chamber of Commerce; Building Code Commission, Portland, Me.

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Robert Scott, Superintendent of Insurance of the Atlantic Coast Line Railroad Company, has worked out a series of twenty-six fire prevention and protection rules for posting on a card in the premises of the company. The rules cover the general hazards of smoking, matches, lockers, etc., care and cleanliness, heating hazards, lighting hazards and the care and operation of fire fighting apparatus.

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Paul A. Colwell of Providence delivered an interesting address recently before the Providence Association of Credit Men, taking as his theme the

actual inspection of a building visited imaginatively in his company. This idea not only made his talk more interesting to his hearers but brought before them in realistic fashion the preventable fire hazards so frequently found in the properties in which the Credit Men are employed. After visiting in fancy such a property, traversing it from attic to basement, Mr. Colwell made practical suggestions for preventing the outbreak and spread of fire.

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E. M. Underwood of Portland, Ore., recently visited Spokane, Wash., for an address before the Pacific-Northwest Hardware and Implement Dealers' Association at which he exhibited the lantern slides taken of representative hazardous conditions and delivered an address on fire prevention. As Chairman for several years of the Portland Fire Prevention Committee of the Credit Men, Mr. Underwood's activities finally aroused the attention of citizens in Portland to fire hazard conditions.

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Ralph P. Stoddard, the capable Secretary of the Society Advocating Fire Elimination, was the moving influence at the Complete Building Show held in Cleveland in February. Any one who understands the immense labor involved in an Exposition of this sort will appreciate the remarkable success of the building show. While the S. A. F. E. is an organization composed of firms and companies handling fire-safe materials, lumbermen were not excluded from the Cleveland exhibition and some of the exhibits of the latter were exceedingly attractive.

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Dana Pierce, Vice President of the Underwriters' Laboratories, presided at the last meeting of the New York Chapter of the N. F. P. A. held at the City Club. The program was the discussion of the report of the special committee on the Diamond Candy Factory Fire which was printed in the last issue of the QUARTERLY. Mr. Howard Chapman, chairman of the committee, was the principal speaker.

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E. R. Townsend of Chicago made an interesting talk before the Fire Insurance Club of that city in February on individual responsibility in reducing the fire waste. Mr. Townsend not only emphasized the desirability of personal liability laws but indicated figuratively how fire might be extinguished. He declared that everyone should practice fire drills by himself, imagining a fire in the home and proceeding to fight it. He said: —

He will be surprised at the woeful lack of preparations, but there is still another benefit in going through the motions. It is a psychological phenomenon that men under excitement act for the most part involuntarily. Instead of becoming confused or bewildered they are in possession of impressions created by acts committed under previous similar circumstances. The man who has practiced fighting an imaginary fire will fight a real one with much success.

A little good work at the beginning of a fire often is far more valuable than the entire fire department a few minutes later. While fire spreads rapidly, there is always time to retreat, unless there be an explosion, and it is surprising what results a person can get by smothering a fire with rugs, woolen blankets, using a little water, a chemical or sand.

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The 1915 report of Chief Inspector John H. Kenney of Baltimore contains an interesting item indicating a practice in his jurisdiction which we believe is not commonly followed by inspection departments. During the summer, an inspector was detailed for night duty to inspect buildings in the central section of the city which are protected with fire shutters, for the purpose of ascertaining whether or not the shutters were properly closed at night. In most cases it was found that the shutters were closed. In cases where they were found open, the occupants were requested to require the shutters to be closed each night. Later inspections indicated that these requests were being complied with.

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James E. Latta is continuing his activities in the lecture field. Along with his illustrated lecture on the Underwriters' Laboratories he includes much instructive material on the general subject of fire protection. Mr. Latta recently addressed the Insurance Society of Cleveland.

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Our active member the Ohio State Fire Prevention Association is continuing its campaign for standardizing hose couplings and hydrant fittings in Ohio. The Association has recently printed a valuable paper on the need of co-operation between communities in case of fire from a manuscript prepared by F. M. Griswold of our Committee on Standard Hose Couplings. As one of the results of the work of the Ohio members the city council of Youngstown, Ohio, passed a motion at a recent meeting that a bond issue be made for changing all hydrant and hose couplings to the standard thread. The Ohio Association will be glad to mail copies of the above pamphlet to members desiring to see the same. Another interesting and unusual action by the Association is the amendment of its articles adding to associate membership the wives, daughters and sisters of members. The Association is to extend its educational work by undertaking the organization of the women members throughout the state.

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The Committee on Standard Hose Couplings and Hydrant Fittings has worked out a new record of the hose and hydrant threads in the cities of the United States. This record is now in the press and copies can be furnished members desiring the same by the time this issue of the QUARTERLY is distributed. Mr. Griswold of the committee is working out for the use of the Illinois State Fire Prevention Association fifty-mile circles about Illinois cities similar to the plan originally undertaken for Columbus,

Ohio, and adjacent cities. Springfield and Rock Island have been recently treated in this fashion by Mr. Griswold.

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Insurance Commissioner James R. Young, of Raleigh, N. C., has issued a bulletin for better and safer school buildings with illustrations showing the application of the idea of the enclosed fire tower stairways. Commissioner Young is doing his best to educate the people of his state to better fire hazard conditions.

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Our active member the Mississippi Inspection and Advisory Rating Company of Vicksburg suffered the loss in January of its efficient and faithful Secretary, Mr. David B. Taylor. Mr. Taylor was an ardent and capable supporter of the work of the N. F. P. A. and his death is sincerely regretted by his fellow members.

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Mr. Kelsey L. Walling of Des Moines, Iowa, was a speaker recently at the state convention of the Iowa hardwaremen. Mr Walling is doing much for the cause of fire prevention since taking up his residence in Iowa.

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Mr. Walter I. Fisher of Minneapolis recently addressed the Association of Commerce in Winona, Minn. We have few members more capable than Mr. Fisher in clear, practical discussion of rate-making. He is qualified to show understandingly what a city and citizens may do to keep a municipality up to its proper fire-protection classification.

* * * * *

The Survey Committee of the Cleveland Foundation has issued an interesting illustrated book on the school buildings and equipment of the City of Cleveland. Any one interested in school building construction, protection and management will find this publication full of valuable suggestions. It may be had postpaid for twenty-five cents by addressing the Survey Committee of the Cleveland Foundation, Dr. Leonard P. Ayers.

* * * * *

Our Rochester member the Eastman Kodak Company has issued another of its attractive little booklets "Suggestions on Fire Protection" prepared by Mr. J. F. Ancona, Special Engineer. This issue covers housekeeping in premises using and handling motion picture films. It is handsomely printed and illustrated and has as a foreword a poem in the Kipling manner by Mr. Albert de Roode of our Committee on Laws and Ordinances. Members interested in having this pamphlet may doubtless secure it by sending a two-cent stamp to the Eastman Kodak Company and asking for the fire protection pamphlet on housekeeping.

Harry W. Bringhurst, our Seattle member, the efficient Secretary of the Pacific Coast Fire Chiefs' Association, has recently submitted a comprehensive report to the Seattle School Board advocating the standardization of fire drill signals and making numerous other timely and valuable suggestions for the safeguarding of the lives of children in the public schools. This is a live subject at present throughout the nation.

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Past President C. M. Goddard of Boston who resides in Newton, Mass., has been appointed by the Mayor of that city a member of a fire hazard commission whose duty is to investigate fire conditions in the school buildings of Newton and to report such recommendations as are deemed necessary. None of Mr. Goddard's fellow members of the N. F. P. A. will doubt his ability to render expert service in this direction.

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Chairman W. O. Teague of the Boston Committee N. F. P. A. called the Boston members together in January for a complimentary dinner at the City Club tendered our Philadelphia member, David Knickerbacker Boyd, former Secretary of the American Institute of Architects. Mr. Boyd and Fire Prevention Commissioner O'Keefe were the speakers.

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H. H. Glidden, manager of the Chicago Board of Underwriters, has built a new home at Highland Park and installed automatic sprinklers in his basement, the location where many dwelling fires originate. W. G. Sanderson, manager of the Western Sprinklered Risk Association, is also preparing to build in Highland Park, and will have the basement of his dwelling sprinklered.

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Walter H. Bennett, fire marshal of Illinois, gave his moving picture fire prevention lecture at a recent dinner of the Chicago Credit Men's Association at the Hotel LaSalle.

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J. C. McDonnell, chief of the Chicago fire prevention bureau, spoke last month on the work of the bureau at the joint banquet of the Illinois Manufacturers' Association and the National Safety Council. C. W. Hejda, engineer of the fire prevention bureau, gave a stereopticon talk on "Fire Scenes in Chicago," and led a round table discussion on "What Constitutes an Inspection?"

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The testimonial dinner given by the joint committee on City Departments of New York City to Mr. R. P. Miller, President of New York Chapter, N. F. P. A., to celebrate the completion of his work in revising the New York building code must have sincerely gratified Mr. Miller. Aside from the city officials a goodly number of prominent members

of the N. F. P. A. were present to do honor to Mr. Miller's great service. Our Vice President D. Everett Waid presided and in introducing the toastmaster made an exceedingly happy speech. The first speaker was Hon. George McAneny remembered by our members as a speaker at the N. F. P. A. luncheon last year at Hotel Astor. Past President Robert D. Kohn spoke of the appreciation which the architects have for Mr. Miller's work and Mr. George W. Babb of the National Board paid him a fine tribute on behalf of the Underwriters. Mr. Miller's remarks were given with his usual modesty and emphasized the assistance rendered him in his work by Messrs. Kohn, Franke, Woolson and other men of the fire prevention fraternity. Many other N. F. P. A. members were present, among them Mr. Charles G. Smith, Mr. F. J. T. Stewart, Mr. E. G. Richards, Mr. A. L. A. Himmelwright and Mr. J. P. H. Perry. Mr. Miller is now enjoying a much needed rest before the assumption of new duties.

Fire Alarms at Panama-Pacific Exposition.

Members who, while the great San Francisco international exposition was being planned, evinced a keen interest in its fire protection features, and with the thought of fires at other expositions in their minds, gave critical inspection to these features while visiting the exposition, will be greatly interested in the accompanying table of fire alarms which were turned in during the period of the big show, and the reasons for the same.

We are indebted for this record to our member, Mr. John R. Freeman of Providence, to whom it was sent by the chief mechanical engineer of the Exposition with the following comment: —

I enclose a record of the fire alarms in the Exposition which, compared with previous records at expositions, is quite remarkable. While our protective methods have never been put to a serious test I believe the precautions taken would have enabled us to prevent a fire from making much headway. The Aero fire alarm was called into operation but once by a real fire. This fire occurred beneath a building and had it gotten a start might have proven serious. The smoke from the fire was noticed by one of the guards and he sent in an alarm which came in simultaneously with the Aero alarm. Of course, we are not "out of the woods" yet, and realize that the hazard is much greater than it was during the exposition period, and are taking precautions accordingly.

Following is the list of alarms and the reason for the call. The period covered is from January 14th to December 3rd, 1915. The maximum damage in any instance did not exceed $200.

Date		Reason for Call
Jan.	14	Fire on roof of Machinery Building.
Feb.	14	Overheated ovens in Food Products Building.
	15	Defective wiring.
	15	False Alarm — Food Products Building.
	20	Crossed wires in Stock Farm.
	20	Rubbish fire on dock.
	27	Fire in Washington Pavilion (curtains).

Mar.	2	Fire in basement of Transportation Building.
	2	Auto tank burst in Transportation Building.
	7	Fire in Transformer Vault.
	27	Crossed wires on pole at Baker Street.
April	8	Fire on Scott Street (outside Exposition Grounds).
	16	False alarm (only smoke).
	16	False alarm for smoke in Tower of Jewels.
	20	Aviator Fowler fell in Bay.
	27	Fire in Press Building.
May	14	Fire in Guards' Quarters, Lib. Arts Building.
	18	Auxiliary box pulled by school boy.
	28	Fire in Peanut stand.
	31	Fire on roof of Machinery Building.
June	1	Motor burnt in Food Products Building.
	8	Gasoline explosion.
	12	Fire in ladies toilet — Fine Arts Building.
	24	Fire in waste basket — Fine Arts Building.
July	10	Fire in dyeing and cleaning works (outside Grounds).
	17	Fire in Press Building.
	27	Fire in West end of Food Products Building (motor burnt).
	27	Box pulled for smoke from above fire.
Aug.	2	Small Fire in Alt Nurnberg Cafe, on Zone.
	31	Fire on Roof of Carnation Milk Building.
	31	Fire in Carnation Milk Building.
Sept.	17	False alarm — smoke in Food Products Building.
	30	False alarm — flashlight picture.
Dec.	3	Arc light on pole West of Education — flaring.
Dec.	7	Oil stove overturned in garage near Festival Hall.

In transmitting this table to the N. F. P. A., Mr. Freeman wrote: —

It has occurred to me that this table and comment would make an interesting item in the next issue of the QUARTERLY.

I believe there never has been a great world's fair that has had such excellent engineering supervision from start to finish as the Panama-Pacific. In the two to three weeks that I spent there last summer I was much impressed with the general neatness and order, and I have no doubt that all this had much to do with the freedom from alarms.

Some might argue that the fact that the automatic sprinkler system was not called into action tends to prove that its installation was an unnecessary expense, but as against this we have the experience of the Brussells Exposition and the burning of one of the chief ornamental buildings at the Chicago Exposition; however the propriety of putting in sprinklers would require no argument whatever from those of us who have spent many years in studying the art of fire prevention.

As I see it, this list of alarms is chiefly useful in showing what neatness and system can accomplish in fire prevention, rather than as an exhibit of fire extinguishing.

Desiring to bring this record down to date, Secretary Wentworth addressed a letter of inquiry to Chief Mechanical-Electrical Engineer Guy L. Bayley to ascertain if any fires had accurred since the close of the Exposition. Mr. Bayley replied as follows, under date of March 23rd:

It is gratifying to be able to inform you that since the close of the Exposition we have had no fires of any consequence. During the period of removal of exhibits we were in constant dread of a fire owing to the fact that there was so much loose packing material about, and we were not able to exercise the same control over the activities of Participants as formerly. The exhibits are now cleaned out of the buildings. The Aero fire alarm system was removed some time ago and the sprinkler system is now being dismantled. The high pressure mains

are still in use but as soon as we begin to get the buildings down on to the ground this system will be torn up. We have abandoned two of our fire companies but have one company still on the grounds. The guards have also been reduced to practically a watchman basis.

As matters now stand, in case of a fire getting away from us our only loss would be the salvage value of the buildings, which is a nominal amount.

I believe the Exposition has made history in the matter of fire protection and I voice the opinion of my associates when I state that the success we have had in this connection is largely due to the foresight of the Director of Works in securing the services of a Fire Protection Engineer, and I trust that in any publicity which may be given to the performance here due credit will be given to Mr. W. H. Johnson of the National Board of Fire Underwriters, who was assigned to the Exposition during the early part of its planning and was directly responsible for the fire protection methods adopted and the constant precautions taken at all times for fire prevention.

Mr. Freeman himself was influential in urging the thorough protection of the Exposition upon the Director of Works, H. L. Connick, before the buildings were erected, advising him of the difficulty experienced by a number of exhibitors of the St. Louis exposition in securing adequate insurance.

Building Officials' Conference.

Members will remember the conference of building officials held in New York last year in connection with the annual meeting of the N. F. P. A.

The second meeting of these officials, which is designed to be an annual event hereafter, was held on February 14, 1916, at the Auditorium Hotel, Chicago. About thirty representatives of building departments and bureaus throughout the country were present.

The morning and part of the afternoon sessions were devoted to discussing the recent changes and improvements in building codes and the desirability of giving business officials discretionary power, a large part of that discussion being devoted to the question of the certificate of occupancy.

Other topics that occupied some of the time were: The use of terra cotta blocks and gypsum products, metal lath and wood shingles. The discussion on these various matters proved so interesting that an evening session had to be arranged for in addition to those scheduled. The following important resolutions were adopted by the conference:

"Resolved, That discretionary power should be vested in building officials to vary or modify the law, where practical difficulties arise in its literal enforcement, so that the intent of the law is secured; and that in case the building official declines to exercise such discretionary power an appeal should be to a board of technical experts."

"Resolved, That proper means of egress from every building should be provided in the form of enclosed stairways; that outside metal fire-escapes should not be considered as a required means of egress from new buildings, and that their use should be confined to existing buildings where other means of egress are impractical; and that wherever such fire-escapes are used the opening thereon should be protected by metal sash and wired glass, or by fire-resisting doors with proper fusible links."

The meetings of this conference have up to this time been informal in character. It was decided, however, to form a more permanent organization. Active membership in this conference will be open to any department or bureau administering laws or ordinances affecting the safety of buildings with respect to their construction, fire hazard or sanitation, or to individuals actively connected with such departments or bureaus.

It is intended to hold an annual meeting some time during each winter, and the meetings are to be held in different cities and so far as possible in connection with some exposition or meeting of other organization having somewhat similar interests.

Rudolph P. Miller, (President of New York Chapter, N. F. P. A.) was elected to serve as chairman of the Conference for the next year and James G. Houghton, building inspector of Minneapolis, was elected vice-chairman. Sidney J. Williams, state building inspector of Wisconsin, was elected secretary. Superintendent Carlin, of Brooklyn, and Building Commissioner Forbush, of Newton, Mass., were elected members of the Executive Committee.

On February 15th the members met jointly with the American Concrete Institute, then in convention in Chicago, to listen to and discuss topics that were of particular interest, including a report on building codes so far as they affect reinforced concrete, the construction of reinforced concrete columns and the design of flat slabs.

By the courtesy of the Cement Products Exhibition Company, the members of the building officials' conference attended the cement show running at the Coliseum in Chicago after which a visit was paid to the Underwriters' Laboratories.

Convictions for Arson, 1915.

The record for the number of convictions for arson in different states is an interesting exhibit. Such a record indicates to a considerable extent the degree to which the citizens of each state have been educated on the cause and effect of our fire waste. All of the fire marshals or other public officials having to do directly with the matter of securing convictions for arson tell of the great difficulty in obtaining a satisfactory verdict from a jury. In some states a conviction can only be secured where there is direct evidence that the defendant expected to take human life by his act. Many officials find that the only way they can get a man sentenced is to secure a confession and a plea of guilty from him. An interesting part of the study of results in different states is the decidedly better showing made where the office of fire marshal has been established for several years. In such states the educational work by that official has brought public opinion to the point where a jury is much more likely to convict than is

the case in other states where no educational work has taken place. A comparison between the results in Ohio and certain other states brings out this conclusion very clearly. The following data was obtained as a result of a canvass of fire marshals, insurance commissioners and such other officials as might be expected to have the necessary information. The fact that so many states report no convictions cannot be taken to mean that the crime of arson was not present but does indicate that there is no one making a special effort to punish those committing this crime. In conclusion, it is quite evident that convictions for arson can only be obtained as a result of special effort on the part of some competent official working with an enlightened public opinion.

Alabama: No data.
Arizona: No convictions.
Arkansas: No data.
British Columbia: 2 convictions.
California: No data; San Francisco, 7 convictions, 2 paroled, 5 sent to prison.
Colorado: No data.
Connecticut: No data.
Delaware: No data.
District of Columbia: 3 convictions.
Florida: No data.
Georgia: No data.
Idaho: No data.
Illinois: 30 convictions.
Indiana: 18 convictions.
Iowa: 4 sentenced to penitentiary; 4 paroled; 6 boys sent to industrial school; 3 sent to insane hospital.
Kansas: 5 convictions.
Kentucky: No data.
Louisiana: Report not ready.
Maine: No data.
Maryland: No data.
Massachusetts: Data for 1915 not available at present time.
Michigan: 15 convictions; 10 sent to prison; 4 paroled; 1 awaiting sentence.
Minnesota: Report not ready.
Mississippi: No data.
Missouri: No data.
Montana: No data.
Nebraska: 1 conviction; 3 boys sent to industrial school.
Nevada: No convictions.
New Hampshire: No data.
New Jersey: No data.
New Mexico: No data.
New York: No data.
North Carolina: No data.

North Dakota: 2 convictions.
Ohio: **91 convictions.**
Oklahoma: No convictions.
Oregon: No data; Portland, 12 convictions.
Pennsylvania: 24 convictions and sentenced; 20 confessed and sentenced; 5 confessed and awaiting sentence.
Rhode Island: No data.
South Carolina: No data.
South Dakota: No data.
Tennessee: No data.
Texas: 15 convictions.
Utah: No data.
Vermont: No convictions.
Virginia: No data.
Washington: No data.
West Viginia: 10 convictions (estimated).
Wisconsin: 15 convictions.
Wyoming: No data.

States marked "no data" either did not reply to our request or advised that they did not have any information.

CONVICTIONS FOR ARSON.

By C. C. Hammond.
Fire Marshal State of Oklahoma

Persons charged with arson have realized that it is best to continue their cases when they are set in the district court and always find some technicality to secure a continuance and put the case off with hopes of the evidence against them being destroyed or the witnesses being scattered and in this manner causing the cases against them to be dismissed or secure their acquittal. The penalty for arson, as a general rule, is so great that the jury do not feel that the defendant is entitled to so long a term in our penitentiary, and will acquit rather than find him guilty. It takes more evidence to convict of arson than it does for any other crime for the reason that as a general thing the person who commits the crime does so for the purpose of collecting insurance money, and a prevailing idea among a large number of the citizens of our state is to stick a corporation, regardless of everything else, and when the attorney for the defense appears and faces the jury and tells them that an insurance company insured the property and got its premium, and they should not kick if the defendant did burn the property and that if the defendant is found guilty of the charge, a soulless corporation will not have to pay the insurance, the average juryman will not stop to reason that if he is carrying insurance, he is one of those who help to pay the loss, but blindly leaps over the precipice because the attorney has yelled "corporation."

Fire Prevention Through Adequate Power And Common Sense.

By Clement J. Driscoll

New York Bureau of Municipal Research. (Member N. F. P. A.)

In discussing the fire waste of the country, it is to be remembered that, like the health problem of the community, the problem of fire protection is essentially one of dollars and cents. In other words, like health, protection against fire is a purchasable commodity and can be secured in a large degree by the expenditure of money. But the expenditure of money in the interest of fire protection must be in accordance with intelligent procedure and to the end of obtaining a minimum number of fires rather than wholly toward efficiency in the extinguishment of them.

It is appalling to note that in this country, with a few exceptions, the vast sums of money expended for fire protection are devoted almost entirely to the development of efficiency in fire extinguishment.

The community with the largest fire-houses, the prettiest painted automobile apparatus and the best-dressed firemen, is frequently confident that it is being adequately protected against destruction by fire, although not one dollar may be expended in that community for the prevention of fire. The same community, with its highly prized and properly admired fire department, will sometimes be without even a building code.

The Bureau of Municipal Research, as a result of surveys made in many cities, large and small, throughout the United States and Canada, has concluded that the increased fire waste and loss of life due to fire and panic may be attributed principally to the following causes:

1. The absence in most communities, with the exception of a few large cities, of adequate building regulations.

2. The lack of requirements providing for placing buildings of the older type of construction in a condition which would render them reasonably safe for habitation.

3. The absence in most cities, small and large, of proper fire prevention inspection.

4. The failure in practically all of the cities of the country to provide for an adequate inspection of dwellings, in which the majority of fires occur.

5. The failure of the legislatures to provide municipal officials with adequate power to enforce orders relative to fire prevention.

6. The division of responsibility for the inspection of buildings and the enforcement of fire prevention regulations so as to make it especially difficult to fix responsibility for negligence and carelessness in this kind of work, as demonstrated by the recent Diamond Factory fire in New York, which caused a loss of 12 lives.

7. The failure of the educational departments of the country to provide for the proper instruction of the children in the schools in the matter of fire prevention.

8. The inadequacy of the laws with relation to fire insurance, in that fire insurance companies are not prohibited from paying a loss until the municipal fire department authorities have certified that the fire was not in any way due either to the gross carelessness or culpability of the insured.

9. The neglect of officials to provide for the scientific training of firemen.

All of these causes can be removed in whole or in part in communities of all sizes without the expenditure of any large sums of money. The lack of building regulations throughout the country, as found by one investigating fire-protection conditions every day, is most amazing. In many communities, and indeed in cities of over 100,000 population, not only are the building regulations in force inadequate, but in many instances it is scarcely possible to find a complete copy of the building requirements, because the regulations were adopted so many years ago.

Communities desiring building development, for selfish reasons, frequently permit the construction of fire traps within their city limits rather than lose a large factory of mercantile establishment which is about to locate in their city.

But a few days ago in a city within 40 minutes of Broadway, tenements housing 12 families were observed, being constructed entirely of wood and in such a manner as not only to invite their destruction by fire, but to make the escape of the tenants in case of fire almost impossible.

To provide proper fire-prevention measures it is essential that the city first guard against the construction of buildings of a type which creates a hazard that cannot be reduced by any amount of inspection or auxiliary fire-fighting equipment.

The municipal authorities must be granted the broadest possible powers in the matter of inspecting and enforcing orders relative to fire prevention. The power to enforce these orders must be centralized in one official or one official body in the community. In almost every city where the state undertakes, through a factory or labor department or state fire marshal, to inspect and supervise buildings of a certain class in all communities within the state, regardless of whether the community is equipped with its own fire department, it is the experience of the Bureau that inefficiency results. There is a clashing of authority between the state and the municipal officials which invariably results in permitting dangerous hazards to exist.

The safeguarding of lives and property in a city is primarily the function of the officials of the city itself, and every building within that city should be under the immediate supervision, in so far as fire prevention and protection are concerned, of the fire department of that community, and that department should be held strictly to account for the conditions found to exist.

It is wholly illogical to enact legislation which places five houses on one block under the jurisdiction of the chief of a fire department, and two or three houses on the same block under the exclusive jurisdiction of state officials, when the responsibility, after all, for fire extinguishment and the safeguarding of the lives of the people upon that block is placed upon the shoulders of the chief of the fire department.

Moreover, to reduce the fire waste it is necessary that the fire-fighting force, not only the chief, but all of his firemen as well, have a thorough understanding of every building, its construction, its contents and the hazard it presents within the city. The records of the fire department, if it is to be efficient, must include an adequate description of these buildings to provide the officials of the department with a guide whenever they may be called upon to extinguish a fire therein.

A Municipal Fire-Prevention Commission with the Local Fire Chief as Executive Officer.

Where the state has, for the most part, erred in legislating upon the subject of fire prevention is in its attempts to enact statutes inflexible, complex and intricate, which seek to meet all conditions of building construction. This failure is especially notable regarding the installation of sprinklers. The attempt of many states to describe through legislation the kind and character of a building in which a sprinkler system shall be required has in a large degree proved a failure, for the reason that it enabled dishonest, greedy builders to design buildings which, although constituting a greater hazard than the type of building in which the statute demands the installation of a sprinkler system, do not technically come within the class established by the statute. Therefore, cities should urge that the state give them the power, through a properly constituted fire-prevention commission, of which the fire chief should be the executive officer, to establish rules and regulations and to enforce these rules in the same manner and under the same conditions as if they had been enacted as statutes. For the purpose of establishing a practical, inexpensive and workable body, this commission should consist of the centralized executive, whether he be a city manager or a mayor, the superintendent or inspector of buildings, two citizens, to serve without salary, and the chief of the fire department.

The whole aim of this commission should be in effect to provide for a campaign of education in matters of fire prevention, to create and enforce rules and regulations which will remove from the buildings of the community conditions which make them especially hazardous, to utilize the

services of the uniformed firemen in the making of fire-prevention inspections, and to support the chief of the fire department and his men in reducing the fire waste of the community through inspections which will be properly recorded and reported upon.

As an aid to the firemen in the making of their inspections, and as an aid to the officers of the department in the fighting of fires, all inspections should be reported in detail on specially provided printed forms, upon which there should appear headings calling for detailed information arranged in such a manner that the inspector or fireman must have carefully inspected the premises in order to fill out the answers. So as to insure the removal of conditions reported upon, the regulations of the fire-prevention commission should be so drastic as to empower the chief of the fire department to force the removal of the hazard by causing the premises to be vacated in the event of a refusal to remedy the condition. This power vested in the chief would go a long way toward making safe unsafe buildings.

The average chief of a fire department is very anxious to reduce his fire loss and the hazardous conditions which result in fire, and his enthusiasm is far greater in this matter than that of the prosecuting attorney or the courts with all of their legal technicalities and procedure.

Only a few days ago, in a city a short distance from New York, a condition was observed in a large building which placed that building in constant danger of destruction by fire, and every minute that it remained brought that building closer to destruction, yet the chief of that city had twenty days before requested the prosecuting attorney to proceed against the owner of the property in order to have the hazard removed. His power ended with the filing of this information with the prosecuting attorney, and beyond that he had no method at his disposal either of hastening the remedy for the condition or speeding the prosecution. Consequently, the hazard remained. A fire occurring in this building as a result of this condition could cause a conflagration, and yet the insurance companies would willingly pay the loss and the prosecution of those at present responsible would probably be forgotten.

It is our experience that the fire-fighting force headed by a uniformed chief is in most instances the only body in the community enthusiastic in the matter of enforcing fire-prevention orders. Consequently, to obtain the best results, it is urged that the power of the uniformed chief to enforce conditions which will tend to minimize the chance of fire be everywhere increased.

Last year, of a total of 12,011 fires occurring within buildings in the city of New York, 8,897, or more than 74 per cent, occurred in tenement and private residences.

Inspection of Dwellings by Firemen.

In almost all of the cities in the United States, the majority of the fires occur in dwellings, and yet, except in New York City and a few other places where there is in operation a special tenement-house statute, there

is practically no inspection of dwellings. The result is that the whole effort in cities where there is a fire-prevention inspection service is in the direction of inspecting the large buildings, such as factories, hotels, and the like. These, for the most part, are already the subject of inspection by many different agencies, such as state department, insurance companies, and in many cases engineers employed by the owners of the property, but the dwellings, in which are housed numbers of people and in which the greatest number of fires occur, receive little or no attention from the officials charged with the duty of preventing fires. Not only are they not inspected by the owners and tenants, but they are not the subjects of advice or counsel from experts in matters of fire prevention.

True, a campaign of education through public schools and social centers is effective in bringing to the notice of the occupants of dwellings, common practices conducive to fire; but frequently the housewives who are present at these gatherings never visit the cellars of their own homes, and do not appreciate the extent of the danger which exists in the congested cellar, clothes closet and garret or in the misplaced, unprotected gas jet.

These conditions can only be pointed out to the housewife by the fireman who inspects her home. Moreover, it is the experience of fire chiefs in cities where house-to-house clean-up campaigns have been conducted that the tenant in the dwelling is ever ready to comply with the requirements and orders of the fire department without even the necessity of a written order from the chief. The dangerous condition pointed out by the fireman in the home is usually remedied as quickly as possible without opposition, while the dangerous condition in the large factory and public building usually is not removed until after it has been argued in several courts of law.

When it is remembered that 60 per cent of the fires in America are caused by carelessness, and that 2,000 lives are sacrificed and 6,000 persons injured in fires annually, it should not be difficult to bring about reforms which will make the cities safer.

If the officials would devote as much energy to developing the fire-prevention work of the fire department as they devote to the fire-fighting side it would not be long until America could boast of as low a fire waste and as little loss of life in connection with fire as the European cities.

Ballad of Dead Girls *

By DANA BURNET

Scarce had they brought the bodies down
Across the withered floor
Than Max Rogosky thundered at
The District Leader's door.

Scarce had the white-lipped mothers come
To search the fearful noon
Than Little Max stood shivering
In Tom McTodd's saloon.

In Tom McTodd's saloon he stood,
Beside the silver bar,
Where any honest lad may stand
And sell his vote at par.

"Ten years I've paid the System's tax."
(The words fell quivering, raw)
"And now I want the thing I bought —
Protection from the law."

The Leader smiled a crooked smile.
"Your doors were locked," he said.
"You've overstepped the limit, Max,
A hundred women — dead!"

Then Max Rogosky gripped the bar,
And shivered where he stood.
"You listen now to me," he cried,
"Like business fellers should.

"I've paid for all my hundred dead,
I've paid, I've paid, I've paid —"
His ragged laughter rang, and died —
For he was sore afraid.

"I've paid for wooden hall and stair,
I've paid to strain my floors,
I've paid for rotten fire-escapes,
For all my bolted doors.

"Your fat inspectors came and came,
I crossed their hands with gold,
And now I want the thing I bought,
The thing the System sold."

The District Leader filled a glass
With whisky from the bar;
(The little silver counter where,
He bought men's souls at par.)

And well he knew that he must give
The thing that he had sold,
Else men should doubt the System's word,
Keep back the System's gold.

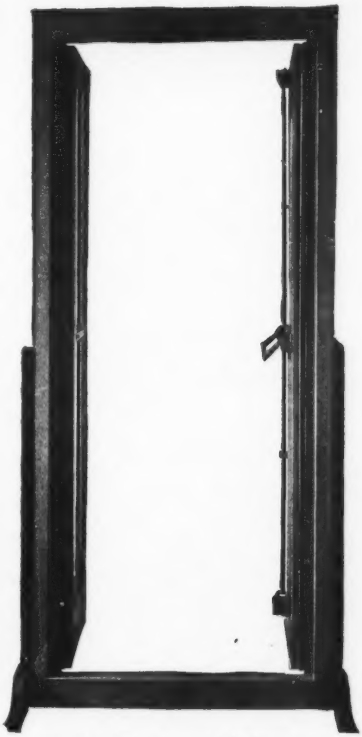
The whisky burned beneath his tongue:
"A hundred women — dead!
I guess the Boss can fix it up;
Go home — and hide," he said.

All day they brought the bodies down
From Max Rogosky's place.
And, oh, the fearful touch of flame
On hand and breast and face!

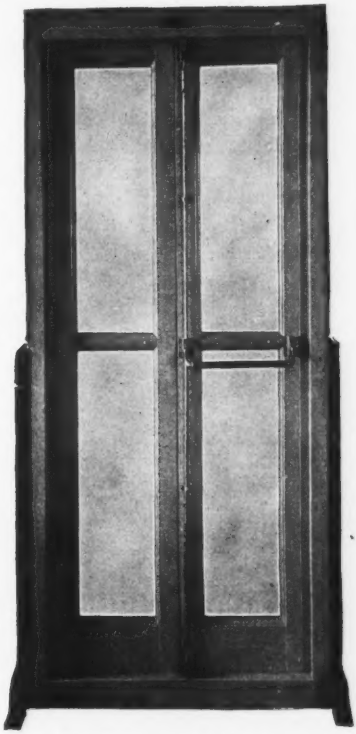
All day the white-lipped mothers came
To search the sheeted dead,
And Horror strode the blackened walls
Where Death had walked in red.

But Max Rogosky did not weep
(He knew that tears were vain);
He paid the System's price, and lived
To lock his doors again.

*By permission, from Dana Burnet's *Poems*. Copyright 1915, by Harper & Brothers.



Panic bolt casement window open.
View from inside.



Panic bolt casement window closed.
Inside view.

Fire Escape Windows.

So strong is the force of habit and so positively does the sight of familiar objects invade the sense and register subjective impressions that the name of an object even when there are different varieties of it, generally calls to mind the most common type.

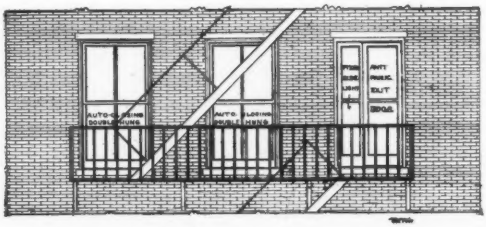
This is true of windows. We commonly use the familiar upper-and-lower sash variety and when we think of a window that is the type we see. Even when we are thinking of a window for egress to a fire escape we may be obsessed by that type. Indeed certain state labor departments and fire prevention bureaus first taking up this matter were so obsessed. Their first regulations required a fixed upper sash and a sliding lower sash for windows opening upon fire escapes. The thought in such requirement was to avoid possible confusion in the movement of both sashes. To raise the lower sash was the only procedure; the upper sash could not be

moved down nor drop down in the way. The windows prescribed were of course of metal frames and wired glass calculated to prevent, when closed, the issuance of fire through the openings upon the fire escapes.

The departments of sanitation soon brought their criticisms to bear upon the window with the fixed upper sash. If a window is to be useful for ventilation it must not be impossible to lower it to permit passage of air at the top. Hence the labor department collided with the department of sanitation and out of the heat of the collision came the idea that for purposes of egress to the platform of a fire escape the casement type of window was the logical equipment.

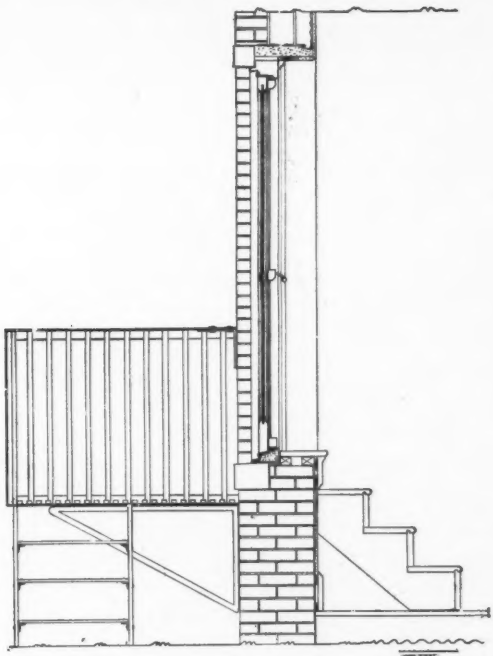
We are presenting herewith illustrations of a casement window designed by an enterprising manufacturer for fire escape exits calculated to meet the requirements of states like New Jersey which demand a "reasonable" exit to a fire escape.

This casement window can, if desired, be made single or double. It is planned to open out. The designers recommend for fire escape purposes



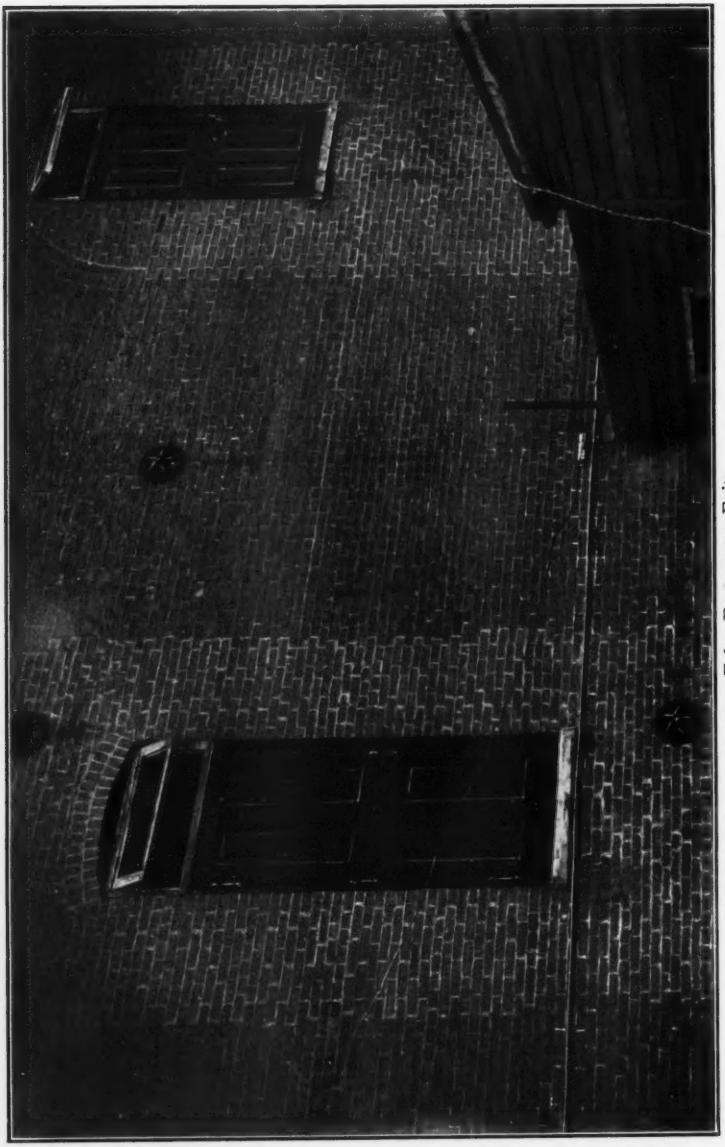
Showing necessary windows at fire escape, one of which is the above panic bolt casement having a two-foot opening and remainder a stationary glass section.

a window part casement and part stationary so divided that the casement will in all cases allow a two foot passageway. This is calculated to prevent congestion and regulate the passage down fire escape stairs. A single opening can in most cases be found opposite a fire escape of proper dimensions where a casement window can be installed without interfering with a free passage along the fire escape platform. It would probably be undesirable to install more than one such window for each escape platform and in selecting the opening care should be taken that the casement window, the sill of which may be two or three feet above the level of the inside floor, can be readily and easily approached by an inside flight of steps maintained permanently at such an exit. This of course cannot be considered an ideal arrangement as compared with the specifications used in new building operations where the outside fire escape platform is on a level with the interior floors. The platforms of the old fire escapes and many of those recently built are placed a few inches below the outside sill of the window. This gives a situation in which the floors of both escape and building are at different depths from the sill. Unless a



Showing panic bolt casement window, opening out, related to interior floor and fire escape.

flight of steps such as that suggested herein is provided the occupants of a building must scramble out over a window sill several feet above the floor level on to a platform that is reached on hands and knees. It would certainly seem possible to evolve a plan to utilize a casement window through which people may pass rapidly one at a time without scrambling or falling. The accompanying illustrations show casement windows opening out equipped with panic bolts for quick opening from inside. An illustration is also given of a fire escape platform protected by metal window frames and wired glass. The windows not intended for exit are of the regular double hung type equipped with fusible links for automatic closing. The third window is equipped with the casement variety as described.



False Emergency Exits
Exterior View of Exit Doors on Balcony (left) and on Gallery (right)

False Emergency Exits.

Commissioner John Price Jackson of the Pennsylvania State Department of Labor and Industry communicates in a recent bulletin issued from his office the fact of the discovery by one of his inspectors of an interesting and most undesirable pair of emergency exits in a Pennsylvania theatre. With the best of intentions the proprietors of this theatre were maintaining a condition which in an emergency might at any time result in most unhappy consequences.

Two doors originally designed to be used as exits to the outside from balcony and gallery respectively, *opened into space* thirty and forty feet above the ground. The platform or gallery or fire escape therefrom had either been removed or had never been constructed. Other means of egress which Commissioner Jackson's department deemed sufficient having been provided these exits were not necessary, although if satisfactorily equipped they might have been useful as additional safety exits. A few slats were nailed across these doors on the inside of the gallery and balcony indicating that they were out of service, but a rope had been provided fastened to a

False Emergency Exits — Exit Door in Balcony

False Emergency Exits — Exit Door in Gallery

hook in the top of the doorway suggesting the possibility of sliding to the ground. As shown in the accompanying photographs the large *exit* signs had not been removed from the transoms, thus continuing to invite egress in those directions, and in the event of panic certain to be chosen by those not near enough to see that the doors were barred. Frantic people in such an emergency might jam others against these doors, force the fastenings, and precipitate men and women over the precipice of the threshold to the sheer drop below. It is obvious that any appearance of an exit that is really not a secure means of egress, is extremely dangerous. All doorways or other openings at any distance from the ground, and not provided with the regular means of descent, should be securely sealed up and all evidences of their former character eliminated. An instance has recently been cited of a man seriously injured and his wife killed, by walking from a second story doorway that was not sealed but opened into space. The intention had been to build a porch to which this door should lead. In the meantime, this door was not securely nailed or boarded shut, but opened as any other door would open to lead upon a safe flooring beyond it.

The accompanying illustrations show the conditions described in the theatre, and clearly depict the danger in the attracting sign "Exit" appearing over each door.

Loss of Life by Fire.

An effort has been made to secure accurate figures for the loss of life in 1915. Letters were sent to the state fire marshals or the insurance commissioners of all the states asking if they could supply this information. The answers in general were to the effect that they did not have the information and, further, could not suggest anyone from whom it might be obtained. There were a few notable exceptions to these replies, for some of the fire marshals have made a determined effort to obtain this information either through clipping bureaus or by some better method. The best data seems to be that obtained from Fire Marshal Walter H. Bennett of Illinois, who reports two hundred and sixty-three deaths in that state for 1915. This total does not include deaths resulting from scalds or mine explosions. The Industrial Commission of Wisconsin reports thirty-three lives lost in that state. Other fire marshals having the information reported for their states as follows: Indiana, 66; West Virginia, 6 or 7; Ohio, 72 (partially estimated); Michigan, 110; Arizona, 4; District of Columbia, 17; North Dakota, 15; Oklahoma, 39 (excluding Ardmore explosion). It is probable that some of the above are not much better than careful estimates and cannot be relied upon as to complete accuracy.

The only other information obtainable is that given in the published reports on mortality statistics by the United States Bureau of the Census. In 1913 twenty-four states, generally through the Secretary of State's office, reported to the Bureau of the Census the deaths which had taken place during the year and their cause. The data from these twenty-four states is used by the Bureau of the Census because it has been found to include at least ninety per cent of all deaths in those states. The list of causes are one hundred and eighty-nine in number and are those contained in the Manual of the International List of Causes of Deaths. There are two main titles of causes which apply to loss of life by fire:

Cause No. 166, **Conflagration.** This title includes conflagration (to include all injuries of whatsoever nature resulting therefrom); crushed at fire (conflagration); fire (in sense of conflagration); inhalation of smoke (burning building); jumped from burning building; suffocation (burning building).

Cause No. 167, **Burns.** (*Conflagration excepted.*) This title includes burn (conflagration excepted, of any bodily part) by boiling liquid or water; coal oil, corrosive substance, fire, gasoline, kerosene, petroleum, steam, sulphuric acid; burn by vitriol, dermatitis actinica, ambustionis, effects of corrosives, radium, x-rays, explosion of lamp; lamp accident, scald (of any part of body) by steam; sunburn.

Unfortunately Cause No. 167 includes not only those deaths resulting from fire, as in the use of gasoline, explosion of lamps, etc., but also such causes as scalds, sunburn, etc. It is to be hoped that some way may be devised by the government by which these two unrelated causes may be separated and thus not classed under the one broad heading, *burns*. Although this information is valuable it is not at all complete at present, for it covers only twenty-four states which have approximately but sixty-five per cent of the total population. On account of the great detail with which these statistics are compiled one or two years elapse before they are published. The last available information is that contained in the report for the year 1913. A summary of the years 1912 and 1913 is given herewith and if studied with a full appreciation of the causes grouped under the broad heading *burns*, one may obtain a great deal of food for thought.

State	1912			1913		
	Conflagration	Burns	Total	Conflagration	Burns	Total
California	80	144	224	64	153	217
Colorado	4	29	31	10	36	46
Connecticut	17	108	125	13	95	108
Indiana	17	177	194	20	167	187
Kentucky	15	249	264	34	237	271
Maine	14	28	42	5	42	47
Maryland	7	118	125	13	108	121
Massachusetts	68	313	381	79	297	376
Michigan	51	171	222	51	154	205
Minnesota	43	93	136	33	108	141
Missouri	65	236	301	83	175	258
Montana	14	16	30	4	22	26
New Hampshire	4	25	29	4	35	39
New Jersey	46	219	262	23	257	280
New York	155	756	911	204	710	914
North Carolina*	8	47	55	4	50	54
Ohio	57	379	436	73	354	427
Pennsylvania	117	893	1010	91	855	946
Rhode Island	7	56	63	4	52	56
Utah	2	13	15	2	23	25
Vermont	5	24	29	8	18	26
Washington	21	39	60	21	63	84
Wisconsin	32	123	155	22	119	141
Virginia	....	....	....	24	246	270
Total	849	4256	5105	889	4376	5265

*Includes only municipalities having a population of 1,000 or over in 1900.

The population of these twenty-four states for 1913 was estimated by the Bureau of the Census as 63,298,718, or approximately 65.1 per cent of the total for the United States. On that basis the deaths under *Conflagration* for the whole United States would have been 1366, and under *Burns* 6,720, or a total of 8,086 lives.

Bryn Mawr Fire Prevention Study

By Florence Lucas Sanville.

A new impetus toward safeguarding human life has been given to fire-prevention effort by a group of Bryn Mawr Alumnae who, led by members of the class of '89, have — in commemoration of their 25th anniversary — presented to the Pennsylvania Department of Labor and Industry a study for safeguarding from fire the women and girls employed in the factories, mills, and shops of the state. There are half a million of these working women in Pennsylvania, the vast majority of them quite helpless under present conditions to ward off the latent or impending dangers in their surroundings, even were they aware of them. The study has for its immediate purpose the recommendations of Standards of Safety from fire, for adoption by the State Industrial Board. This board, under the act of 1913 which created the Department of Labor and Industry, has the power "To make, alter, amend and repeal general rules and regulations" so as to provide "reasonable and adequate protection for the life, health, safety and morals of all persons employed".

Up to the present time no safety regulations against dangers from fire have been adopted, because the necessary facts upon which to base these rules have been lacking. The Bryn Mawr Fire Prevention Committee has, at the request of Commissioner John Price Jackson, undertaken to furnish this material. This concrete object, however, represents only partially the hopes and purposes of the group who have initiated this study. There is an educational work to be done, without which the most carefully-drawn regulations must fail of their complete attainment. During the five months in which the study has been in progress, the need of a more intelligent comprehension by both employers and workers of simple facts for their own safety has been vividly apparent. Such education is possible only through a more wide-spread public interest than has yet existed; and it is the hope of the Bryn Mawr Committee that similar undertakings will follow this pioneer effort-creating centers of permanent interest which will take the place of the sporadic sentiment that now flares up after a catastrophe only to subside as quickly.

In this undertaking appears perhaps the first effective breach in the Chinese wall which has heretofore stood between expert knowledge and public interest in this subject. In developing the study, there has come into working contact a group of women able, through normal channels, to reach a wide public — and a group of nationally recognized fire-prevention experts. Moreover, the services of these combined forces have been placed at the disposal of the State, which — through its Commissioner

of Labor and Industry — has assumed a general direction of the work. Thus it is that the plan has worked out.

The Study is being conducted under the joint supervision of Fanny T. Cochran, a Bryn Mawr graduate, and the writer of this article. Both Miss Cochran and myself have had long practical experience in the study of industrial conditions; moreover, as Secretary of the Consumers' League of Eastern Pennsylvania for nine years, the writer was instrumental in framing and securing the enactment both of the Women's Labor Law and the act creating the Department of Labor and Industry two years later. Neither of us, however, is possessed of the technical knowledge essential to a scientific study of fire prevention; and the first step in the study was, therefore, to obtain access to expert opinion. The success which this initial endeavor met is in itself a tribute to the public spirit of the Fire Prevention experts of our country. Every one of the nine men who were approached on the subject gladly offered his services; and these have been given without remuneration, and even without compensation for expenses which are involved for those who live at a distance from Philadelphia. The Advisory Committee thus formed consists of the following gentlemen: From New York, Mr. Joseph O. Hammitt and Mr. H. F. J. Porter; from New Jersey, Colonel Lewis T. Bryant; from Philadelphia, Mr. H. W. Forster, Mr. D. Knickerbacker Boyd, Mr. C. A. Hexamer, Mr. Powell Evans, Dr. S. S. Huebner of the University of Pennsylvania; and from Harrisburg, representing the State Department, Mr. Lew R. Palmer.

The work has seemed to fall naturally into two divisions: (1) A study and analysis of the laws, regulations, and administrative machinery of Pennsylvania, with a parallel study of these points in other states which have advanced furthest along these lines; (2) a survey of prevailing conditions in the industrial and commercial establishments of Pennsylvania.

In developing these activities, two additional sources of help have been drawn upon. The Department of Insurance of the University of Pennsylvania offered the services of an advanced student in compiling the bibliography and in carrying on the research work, while a member of the Philadelphia bar has made a very complete and exhaustive compilation of the laws and municipal ordinances of Pennsylvania, with an analysis of overlapping jurisdictions. This has proved a formidable document, exposing certain statutory weaknesses which it will be the aim of the Committee to bring to the attention of the public.

The field survey is being accomplished through the close co-operation of the Bureau of Inspection of the Department of Labor and Industry, which has given the services of Mr. Walter G. Lloyd, a fire prevention expert, in helping to carry on the survey. Incidentally, a series of photographs has been taken, which when published will perhaps speak more loudly of conditions found than would pages of text.

It is naturally not the purpose of this article to describe in detail the progress of the work or the conditions found. To do this would destroy the effect of the report which will appear when the work is completed.

One general statement can be made here, however, which justifies and bears out the effective appeal made by the National Fire Protection Association. This is, that negligence in housekeeping and ignorance of the rudiments of careful management have been found to offer certainly as serious a menace to life as do structural defects. This fact is directly in harmony with the weight of emphasis which, by general consent, the study is distributing among the several factors of fire preventive effort. Details of building construction are receiving less emphasis in the survey than are the factors of management, housekeeping and equipment. Moreover, the questions involved in building construction will be met by the proposed building code which has been drawn up by a state commission, appointed by Ex-Governor Tener and is now being printed for distribution and study. Such recommendations as the present study will have to make on building construction will largely concern themselves with the points as they are covered in the new code. For the purpose of making such recommendations an analysis of the fire prevention sections of the code is being made by a sub-committee. In addition to the material contained in this new and exhaustive code, the survey has revealed certain simple but flagrantly dangerous conditions — such as the prevailing outside iron fire escape, climbing down past non-fire proof windows and doors — which are very inadequately dealt with in existing statutes and must receive an important place in the report.

The function of the final report however, will be less to demand complex statutory requirements, than to suggest readily enforcible rules, and methods of enforcing these when adopted. It must be borne in mind in this as in other legislative matters, that more mischief is done by the inability to make existing regulations living facts than by the lack of such regulations. As one sees the combination of circumstances on every hand to which these conditions have given rise in many factories and shops, the wonder is, not that there are tragedies — but that there are not more of them.

It is thus the hope of the group who initiated this effort to be of practical service to the community. The fact that this group is composed of women gives it perhaps a unique interest in the direction of fire prevention. An instance — extreme it is to be hoped — of this unusual element in the situation occurred in the attitude of one of the factory proprietors whom we have visited in the course of the survey. He was one of the few men who were resentful and obviously unwilling to co-operate; and as Miss Cochran and I left the building, followed by the inspector who accompanied us, we heard him give a muttered exclamation in a voice too low for us to catch the words. We inquired its purport from the inspector, who replied, "It was not very complimentary and not just the thing to repeat". We urged him further and learned that the exclamation had been, "Those G—— d—— women!"

This man forgot that the vast majority of victims of factory fires have always been women. But it was because this fact was remembered by those who made this gift to the State that the undertaking is what it is.

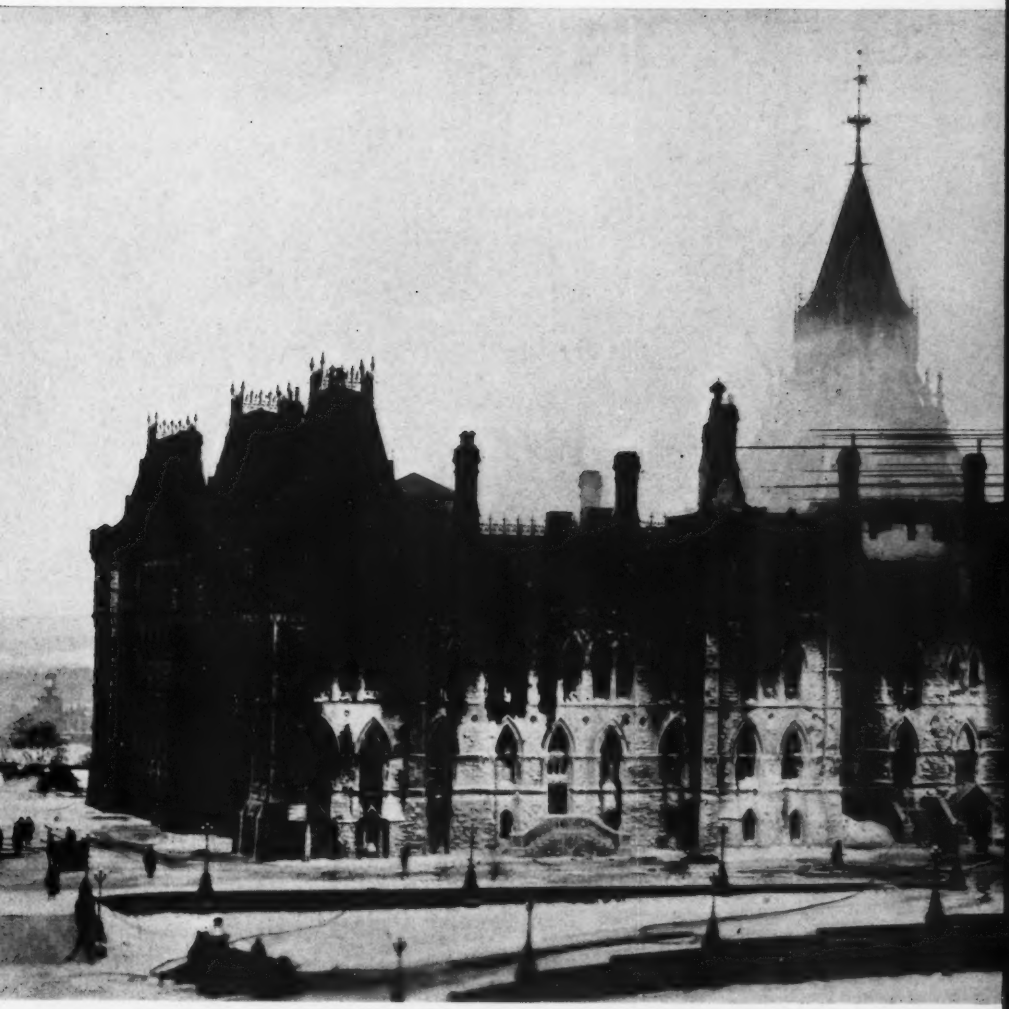
In the words of the Bryn Mawr Committee, "It has been proven how deeply the fate of the young workers in New York and Binghamton, and but recently in Pittsburgh and Williamsburg, has left its impress on the community. If this investigation succeeds in rousing the wider public from its mood of apathy and wins its sympathy and co-operation, a public sentiment will, it is hoped, be created powerful enough to minimize or even to eliminate the fire danger which hourly imperils the lives of thousands of young girls and women in industry."

Ottawa Parliament Building Fire.

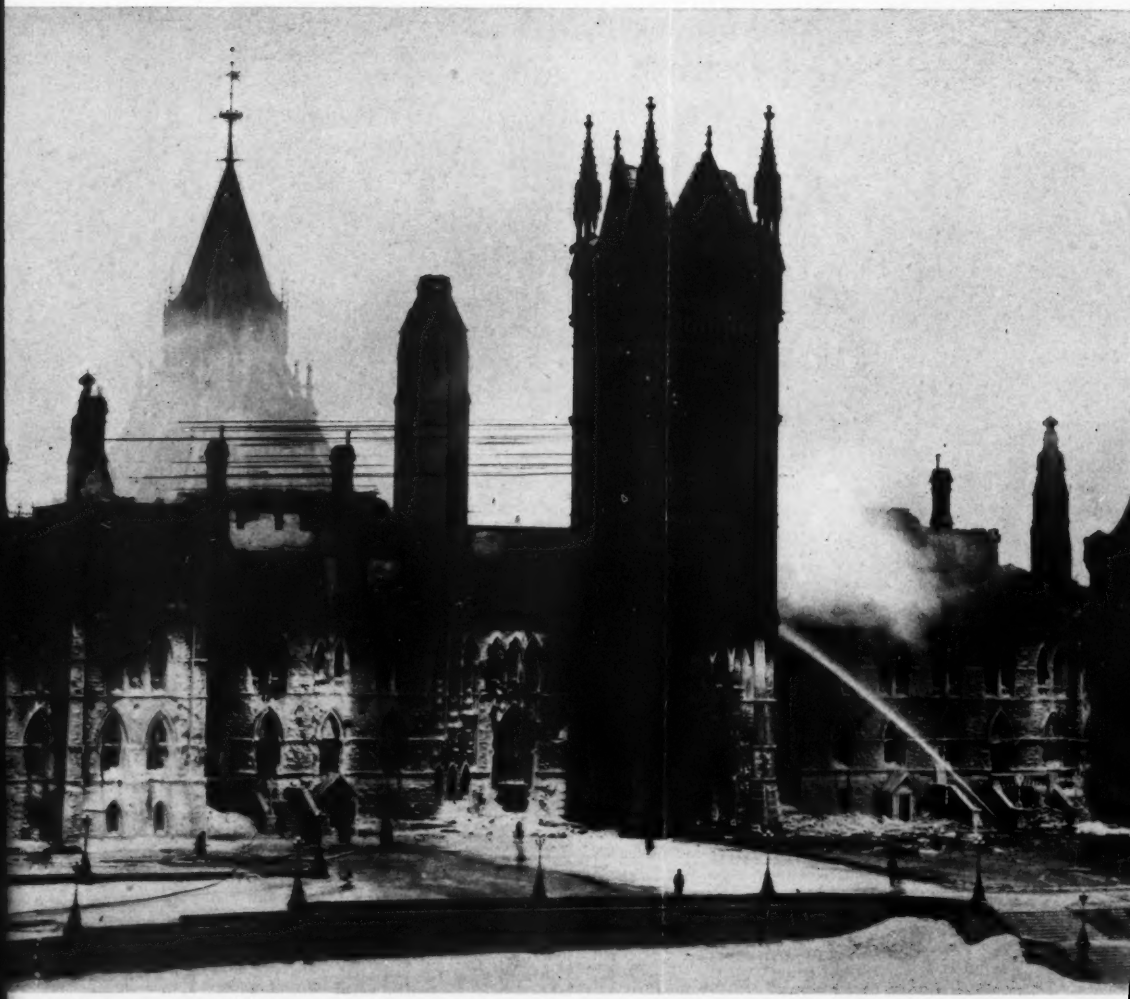
(See Frontispiece)

The Parliament Building in Ottawa, Canada, was swept by fire on the night of February 3. The fire was first seen in the reading room of the House of Commons from whence it spread so rapidly through unprotected vertical and horizontal openings that the building was already doomed when the fire department arrived. The fire occurred while the House of Commons was meeting and members of parliament and others in the building had difficulty in escaping. Two women, guests of the wife of Speaker Sevigny, were found unconscious by firemen and died later. At least two men lost their lives, it is stated in reports. Many people who could not escape by way of the smoke filled halls were rescued by firemen with ladders and others leaped into life nets held by firemen. A number of firemen and policemen were covered with debris when part of the structure collapsed. At 1.30 A. M. the tall central spire fell. At 3 A. M. when the fire was under control the flames had swept through the House of Commons and Senate wings but the firemen had succeeded in saving the wing occupied by the valuable parliament library. The books had already been removed to places of safety by firemen and soldiers. The building, which cost more than $6,000,000, included a central building with two side wings, in all four hundred and seventy feet in length, with a tower two hundred and twenty feet high and the library building in the rear. The building was erected in 1859-1860 and covers an area of four acres.

The destruction of this building will appear to those who have seen pictures of the structure as quite a remarkable occurrence. The building presented a very solid and imposing appearance; built of sand-stone that would appear to the observer as being of fireproof construction. It must be remembered, however, that at the period when it was erected, fireproof construction was little thought of, timber and wood were used wherever convenient. After fifty-six years of drying and seasoning, the wood employed in the interior of the building burned like tinder and this, together with the great size of the structure and the great area covered, along with the free passages of fire communication throughout the entire structure, will account for the rapidity with which the building was destroyed.



General View of Ruins of Parliament



neral View of Ruins of Parliament Building at Ottawa, Canada, Smouldering on Morning After the Fire.

he Fire.

Approximate Nozzle or Engine Pressures.

By George W. Booth, (Member N. F. P. A.).
Chief Engineer National Board of Fire Underwriters.

The following are methods of determining approximate nozzle or engine pressures with hose lines made up of two different sizes of hose, siamesed lines or a single line branching into two.

A fairly common form of example in hose layouts is one involving siamesed lines, or a line made up of two different sizes of hose. These can be worked easiest by reducing the siamesed lines, or the different sizes of hose all to an equivalent length of 2½-inch hose, that is, to a length of 2½-inch hose which will give the same total friction loss as the siamesed line or the combined lines. To enable this to be done certain factors have been determined, based upon the relative friction loss of the different sizes and combinations of hose. These factors (f) are given below:

Single Lines.

	2¾ in.	3 in.	3½ in.	4 in.	4½ in.	5 in
f =	1.66	2.6	5.8	11.0	19.5	32.0

Siamesed Lines of Equal Length.

	2-2½ in.	3-2½ in.	2-3 in.	3-3 in.	1-3 in. 1-2½ in
f =	3.6	7.75	9.35	20.4	6.1

For an example indicating the use of the factors: From a high-pressure hydrant, one 400-foot line of 2½-inch hose and one 400-foot line of 3-inch hose is siamesed into a 600-foot line of 3-inch hose, which connects to a 400-foot line of 2½-inch hose having a 1¼-inch tip; what pressure will be necessary at the hydrant to give 50 pounds nozzle pressure?

The factor for siamesed lines of 3-inch and 2½-inch is 6.1; then the length of 2½-inch hose equivalent to the 400 feet of siamesed lines is $\frac{400}{6.1}$, or 65 feet.

The factor for 3-inch hose is 2.6; then the length of 2½-inch hose equivalent to the 600 feet of 3-inch is $\frac{600}{2.6}$, or 230 feet. Therefore the total equivalent 2½-inch line is 65 plus 230 plus 400 feet, or 695 feet, which can be assumed as 14 lengths.

Using the constant (K) for 1¼-inch nozzle, as given on page 25 of

the National Board of Fire Underwriters' book on "Fire Engine Tests and Fire Stream Tables," we can solve the problem with ease, as follows:

$$\begin{aligned}\text{Engine pressure} &= 50\ (1.1 + 249 \times 14)\\ &= 50\ (1.1 + 3.47)\\ &= 50 \times 4.57\\ &= 228 \text{ pounds}\end{aligned}$$

For siamesed lines of hose of same diameter, but of different length, the following rules may be used:

Siamesed lines, one twice as long as the other, equal one line one-third the length of the shortest.

Example: One line 300 feet and one line 600 feet siamesed are equal to one line 100 feet long.

Siamesed lines, one three times as long as the other, equal one line 0.4 the length of the shortest.

Example: One line of 500 feet and one line 1,500 feet siamesed are equal to one line 0.4 ×500, or 200 feet long.

For the problem involving a single line of hose branching into two lines, each with a separate nozzle, it is necessary to find the length of a single line having the same friction loss as the two parallel lines, and the size of a single nozzle equivalent to the two on the lines in question. Equivalent nozzle sizes may be taken from the attached table and the equivalent length of a single line may be found by the use of the factors given in the preceding problem. It is not always possible to find a nozzle size for use in the formula on page 25, Fire Engine Tests pamphlet, which is the exact equivalent of two or more smaller nozzles, but a close approximation can usually be made.

For an example indicating the method of working out this problem, consider a single 500-foot line of 3-inch hose branching into two 300-foot lines of 2½-inch hose, each with a 1⅛-inch nozzle. Assume a pressure of 150 pounds at the engine and determine the nozzle pressure.

Two 1⅛-inch nozzles are approximately the equivalent of one 1⅝-inch nozzle.

The factor of 3-inch hose is 2.6, and the length of 2½-inch hose equivalent to 500 feet of 3-inch is $\frac{500}{2.6}$ or 192 feet.

The factor for two lines of 2½-inch hose is 3.6, and the length of a single line of 2½-inch hose equivalent to two 300-foot lines is $\frac{300}{3.6}$ or 83 feet.

This combination of hose and nozzles is, therefore, the equivalent, that is, will deliver about the same amount of water, as one 1⅝-inch nozzle on the end of a line of 2½-inch hose, 192 + 83 feet long = 275 feet. Using the formula on page 25 of the Fire Engine Tests pamphlet, we have then:

$$\text{Nozzle pressure} = \frac{150}{1.1 + 5.5 \times 0.68} = 31 \text{ pounds.}$$

By using the table on page 28 to determine the discharge at 31 pounds nozzle pressure through a 1 ⅛-inch nozzle, and table on page 27 to determine the friction loss in 500 feet of 3-inch hose and two 300-foot lines of 2 ½-inch hose, we find that the solution is not exactly correct, since the 31 pounds nozzle pressure in the problem above will actually require, allowing about 3 pounds loss at the engine outlet and the same at the Y branch, only 146 pounds engine pressure. The error in this case arises from the fact that two 1 ⅛-inch nozzles are not quite the equivalent of one 1 ⅝-inch. The solution of the problem given above is, however, sufficiently close for all practical purposes.

No. of Nozzles.	Approximate Comparison of Nozzles. — In Inches.					
1	⅝	¾	⅞	1	1⅛	1¼
2	⅞	1 1/16	1¼	1⅜	1⅝	1¾
3	1 1/16	1 5/16	1½	1¾	1 11/16	2 3/16
4	1¼	1½	1¾	2	2¼	2½
5	1⅜	1 11/16	2	2¼	2½	2¾
6	1½	1 13/16	2⅛	2 7/16	2¾	3 1/16
7	1⅝	2	2 5/16	2⅝	3	3 5/16
8	1¾	2⅛	2½	2 13/16	3 3/16	3 9/16
9	1⅞	2¼	2⅝	3	3⅜	3¾
10	2	2⅜	2¾	3 3/16	3 9/16	4
11	2 1/16	2½	2⅞	3 5/16	3¾	
12	2 3/16	2⅝	3	3½	3 15/16	
1	1⅜	1½	1⅝	1¾	1⅞	2
2	1 15/16	2⅛	2 15/16	2½	2⅝	2 13/16
3	2⅜	2⅝	2 13/16	3	3¼	3½
4	2¾	3	3¼	3½	3¾	4
5	3 1/16	3⅜	3⅝	3 15/16	4 3/16	
6	3⅜	3 11/16	4			
7	3⅝	4				
8	3⅞					
9	4⅛					

KEY—One 2-in. nozzle = five ⅞ in. Four ¾-in. nozzles = one 1½ in. See dotted lines.

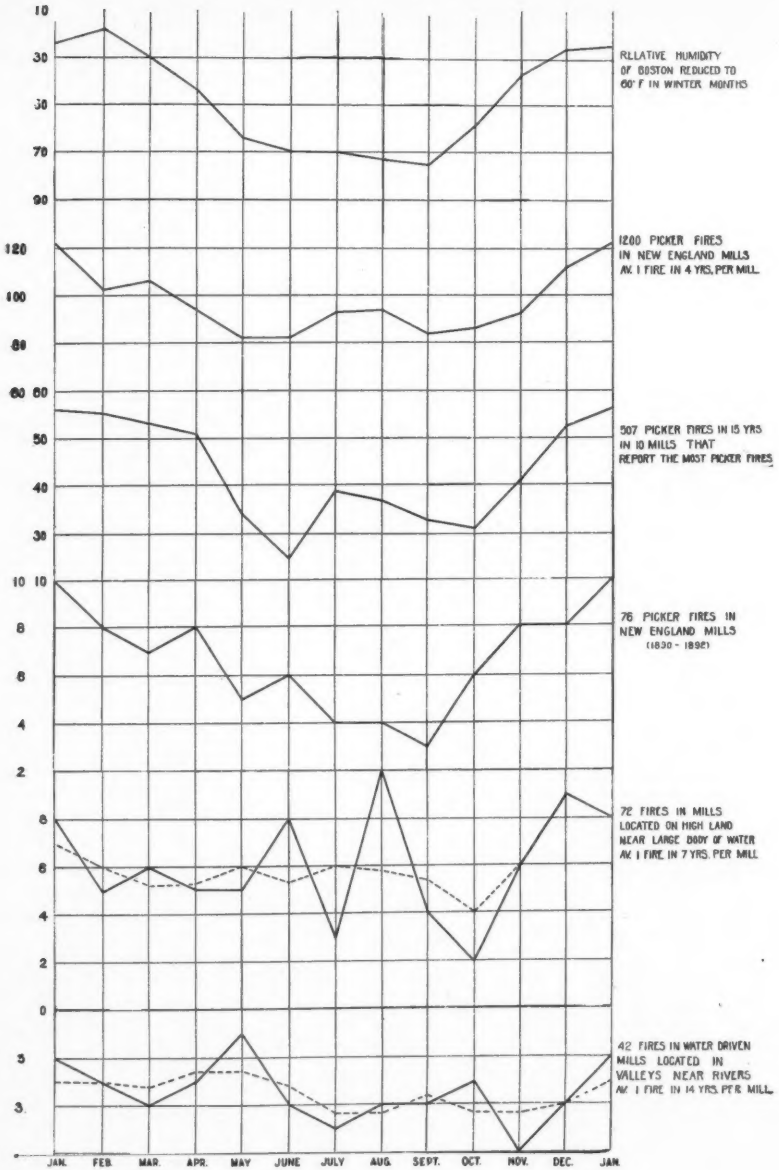

RELATIVE HUMIDITY OF BOSTON REDUCED TO 60° F IN WINTER MONTHS
1200 PICKER FIRES IN NEW ENGLAND MILLS AV. 1 FIRE IN 4 YRS. PER MILL
507 PICKER FIRES IN 15 YRS IN 10 MILLS THAT REPORT THE MOST PICKER FIRES
76 PICKER FIRES IN NEW ENGLAND MILLS (1830 - 1892)
72 FIRES IN MILLS LOCATED ON HIGH LAND NEAR LARGE BODY OF WATER AV. 1 FIRE IN 7 YRS. PER MILL
42 FIRES IN WATER DRIVEN MILLS LOCATED IN VALLEYS NEAR RIVERS AV. 1 FIRE IN 14 YRS. PER MILL
JAN. FEB. MAR. APR. MAY JUNE JULY AUG. SEPT. OCT. NOV. DEC. JAN.

Fig. 1
Humidity a factor in cotton picker fires

Humidity a Factor in Cotton Picker Fires.

By F. J. Hoxie, (Member N. F. P. A.).

Engineer and Special Inspector Factory Mutual Fire Insurance Companies.

Cotton picker fires are commonly attributed to "foreign substance in the stock." This foreign substance is supposed to be stones, pieces of metal and matches, and undoubtedly this cause is responsible for a majority of the picker fires. There is no reason for supposing that there is more tendency for any of these materials to be present in the cotton at one time of the year than at another, therefore if a large number of picker fires in a given group of mills are plotted for each of the twelve months of the year, the curve to be expected is a straight line. When such fires are plotted from a given group of mills in a northern climate the resulting curve is not a straight line, but is of quite constant form when taken for different groups of mills or for different years, provided that the mills are located in northern latitudes. This curve shows that there are more picker fires in the winter months than in summer, and more in dog days than in May and June, and October.

It has been suggested that the cause of this excess may be artificial heating or lighting, but as fires from these sources are easily identified it seems hardly probable that such a large proportion of the total number could be from these causes. The relative humidity of the picker room suggests itself as a more probable explanation. The following curves show the distribution of picker fires in several years in groups of New England mills, together with the relative humidity of Boston from Government records reduced to a temperature of sixty degrees F., as representing the approximate condition in the picker room in winter.

When the relative humidity in the picker room is below twenty-five per cent the cotton may become so dry that it is readily ignited by a small spark and when it is above eighty per cent cotton becomes so limp that it winds up and packs on moving parts of pickers, thereby causing fires.

The first condition is indicated by the following curves, showing the relative humidity of picker rooms for each day of several months in which there has been an exceptionally large number of picker fires in this group of mills. It is apparent that there is a decidedly greater tendency to an excessive number of picker fires in very cold weather, with the inside relative humidity below twenty-five per cent than in weather in which the relative humidity is above this amount. I have therefore called twenty-five per cent relative humidity the danger line

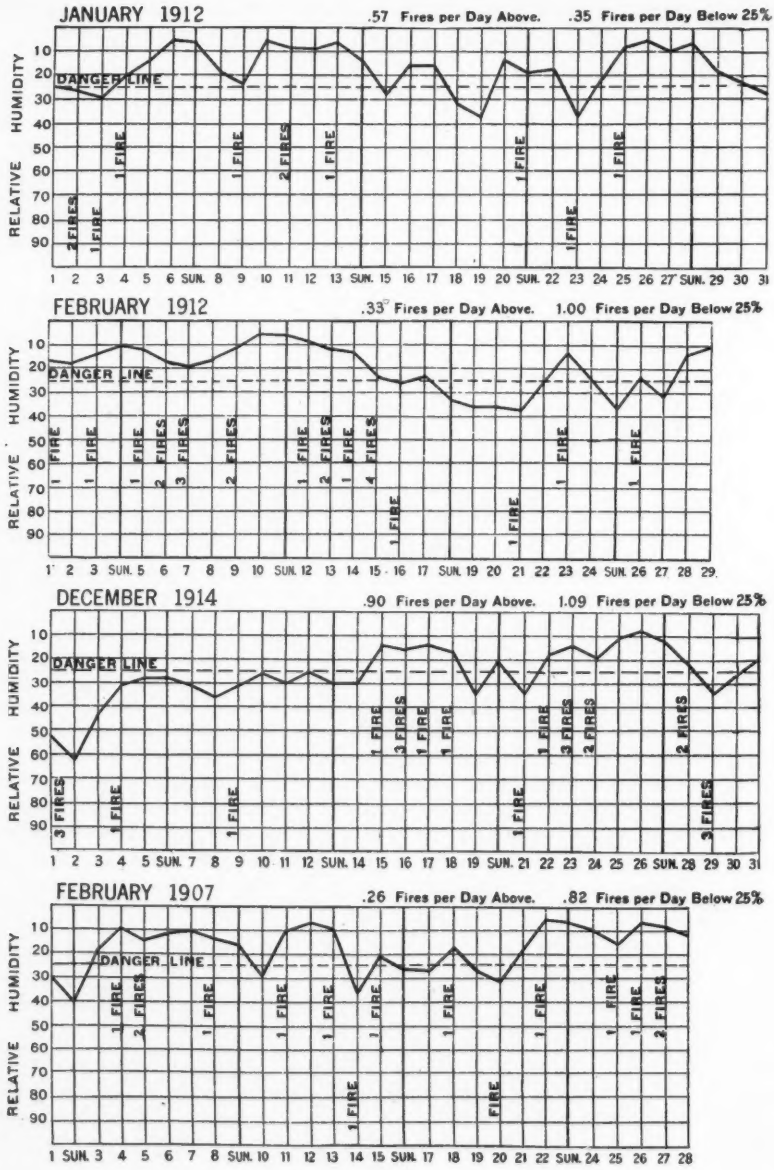

JANUARY 1912
.57 Fires per Day Above.
.35 Fires per Day Below 25%
RELATIVE HUMIDITY
DANGER LINE
FEBRUARY 1912
.33 Fires per Day Above.
1.00 Fires per Day Below 25%
DECEMBER 1914
.90 Fires per Day Above.
1.09 Fires per Day Below 25%
FEBRUARY 1907
.26 Fires per Day Above.
.82 Fires per Day Below 25%

Fig. 2

Humidity a factor in cotton picker fires

and given the number of fires per day reported on days when the humidity was below this line and the number per day when it was above. The averages for eight months in which the numbers of picker fires had been abnormally large are .49 fires per day on working days with the relative humidity of the picker room above twenty-five per cent, and .78 fires per day with the relative humidity of the picker room below twenty-five per cent.

These observations indicate that a part of the cotton picker fires could be prevented by avoiding both extremes of humidity in the picker room. It is probable at the same time that the work in the card room will be sufficiently improved to pay for the small amount of care necessary to avoid these extremes.

Electric Sign Construction

By William S. Boyd (Member N. F. P. A.).

Secretary Western Association of Electrical Inspectors

From the very earliest days we have looked for signs of one character or another, and it is hardly necessary at this day and generation to even suggest the advisability of their use, or to inquire as to their necessity or the reason for their existence. Signs, as a rule, have become a very potent form of publicity for the purpose of bringing to the attention of the public information concerning person, place or thing. As used in the modern mercantile world signs are very effective in bringing the general public in touch with facts in a striking as well as a pleasant manner.

Sign Requirements.

The requirements for an attractive sign are as follows:

1. Good definition or clearness.
2. Neatness of design and execution.
3. Completeness or comprehensiveness, both as to subject matter treated and construction and other important details; in other words, there should be nothing lacking.
4. Continuity, ruggedness, reliability, both of construction and materials used.

Full compliance with these details produce what is generally termed an artistic sign.

Mechanical Details.

1. **Construction:** Too much attention can not be paid to the construction details of the electrical sign. Manufacturers and owners who have had considerable experience with them will appreciate the value of

this suggestion. The best standard extant seems to be that adopted by Underwriters' Laboratories to be used in connection with the inspection and labeling of signs, and the value of maintaining this inspection service must be apparent to both manufacturer and purchaser.

2. Installation: In view of the terrific strain put upon signs by storms, which are more or less prevalent throughout this country, it behooves manufacturers or installers of signs to see that only first-class practice in this matter is adopted. The average electrical sign is of considerable value if properly constructed, and every effort should be made to securely fasten it to the building or other structure used as a support.

3. Inspection: In addition to the inspection which all sign installations should have both during construction and installation period, a careful re-examination of these details should be carried on and every bit of material which shows defects should be immediately eliminated.

4. Maintenance: There is little to be accomplished by the construction and installation of an excellent sign unless it is maintained in a proper manner. If the sign is not to be maintained, it should be removed at once; otherwise the effect sought to be produced by the sign will be reversed. Signs that are poorly maintained are a detriment to the owner. Have you ever viewed an old sign on the roof of some building, or out on the meadows, or on some vacant lot, which has been allowed to become dilapidated or partly destroyed, or which has become out of shape for various reasons? If, after viewing such exhibits, you analyze the thoughts which are prompted by such scenes, you will realize that they run along a line that is at least contrary to that which the owner of the sign hoped to stimulate. You probably wonder whether or not the building in question is vacant, or if the former tenant has moved out. If so, where has he gone? Has the firm gone out of business, or does it lack sufficient enterprise to maintain the sign in proper condition? Would this be a fair indication of the way this firm looks after the balance of its business? In other words, are its products and customers treated in the same way? There is a feeling within you that something is lacking, and, as far as this sign is concerned, you are rather inclined to trade elsewhere. In other words, the thought is started in a wrong channel rather than in a right one. It is often the small details about a sign which do the work and produce the impression, whether good or bad. The well-designed sign leaves one with a sense of comfort, pleasure and admiration, and this often dwells in the thought for years at a time. This recollection often stimulates interest in the goods which the sign owner is handling. A poorly designed sign produces the opposite effect.

Remedy.

If the sign is a very important factor in commercial life, a special effort should be made to produce the best results with the least expense,

and authorities agree that this result is attained by the exclusive use of the *all-metal* sign, properly installed.

All-Metal Reasons.

1. Metal is more susceptible to manipulation, and seems to meet every possible requirement of the designer.

2. The all-metal sign, properly protected, becomes practically indestructible. There are no loose screws. Pieces are not readily knocked off, as is often the case with signs constructed of wood.

3. The metal sign can be constructed with a greater factor of safety, using the same weight and space.

4. The all-metal sign is fireproof; in other words, it is never involved in the starting or spreading of fires. In the early days of electricity, cut-out cabinets were almost universally manufactured of wood. Now, the wooden cabinet is seldom seen, except in the small towns. There is need that the sign enclosure shall be fire-resistive because it houses a great deal of inflammable insulation, and it should be rugged so as to protect the insulation of the wire and the rather fragile receptacles and other electrical apparatus from mechanical injury and excessive moisture.

5. All-metal signs can more easily be made waterproof than those constructed of wood, and it is a more simple matter to drain them also.

6. All-metal signs are the least difficult to ship without damage.

7. All-metal signs are wired and equipped with electrical fittings with less difficulty than those constructed of wood.

8. The all-metal sign has greater flexibility and will not give way under strains as readily as the wooden sign.

9. All-metal signs are less susceptible to warp and to distortion from heat and moisture than is the sign constructed of wood.

A Few Installation Cautions.

Signs for installation on roof-tops should be so designed and installed that they will not operate to interfere with the work of the firemen. The complete accessibility of the roof is sometimes very desirable from the fireman's viewpoint. The all-metal sign is almost a necessity in order to avoid assisting the spread of fire, should one occur in the neighborhood.

Signs placed upon fronts of buildings should be so disposed as to leave windows as free as possible.

Chains should almost invariably be used to support signs, unless steel rods are available. These should be securely bolted to the building as well as to the sign itself.

Where small signs are concerned, expansion bolts might be used with safety, but as a general rule the bolts should pass through the walls with some washer protection to prevent the head from being drawn through. The chains should be so disposed as to avoid interference with the work of the firemen handling ladders.

A Few Electrical Hints.

Wiring insulation should be carefully selected and the supports should be carefully placed, as the sign is subject to considerable vibration, owing to the wind and general building vibration.

Receptacles should be of proper design, so that attachment to the sign can be made in such a manner as to prevent any strain from coming upon the conductors which may be attached to the receptacles. The wires supplying current to the receptacles should be connected in a workmanlike manner, so as to prevent the possibility of an open circuit, and later these terminals should be protected against corrosion by means of insulating compound of some sort. It is desirable to keep sign circuits down to the 1320 watt limit, so that in case of trouble on the sign there will not be enough outage among the lamps to render the sign useless or confusing to the public.

All joints or splices should be very carefully made and insulated.

Service Details.

A great many cities are requiring that electric signs shall be fed by means of wires enclosed in conduit. This makes neat construction and adds to the appearance of the installation. Sign makers often ship signs which are provided with lead wires passing through the side of the sign, protected by bushings, and when such signs are used in cities requiring conduit service the electrician often finds it necessary to do considerable work upon the sign before it can be installed. It would seem perfectly feasible for the sign maker to install an outlet box at the point where the wires are to leave the sign, having a cover which may be removed or replaced with another cover having bushed holes for exposed wiring and still another with suitable knockouts for conduit work. Then, signs shipped to any part of the country could, with very little alteration, be available for both open and conduit service wiring.

Conclusions.

Both sign makers and buyers should vigorously support the rigid enforcement of all reasonable rules for the construction and installation of signs. They should advocate the factory inspection service by requiring the exclusive use of labeled signs inspected by the Underwriters' Laboratories. The inspection work conducted under city ordinances should be supported, and as far as possible the use of conduit for service wires should be insisted upon.

Candy, Chocolate and Cocoa Manufacturing with Special Reference to Fire Hazards.

By Nicholas Richardson, (Member N. F. P. A.).
Inspector, Underwriters' Bureau of New England.
Illustrations by courtesy of National Equipment Co.

Definition.

The word Candy is defined by Webster as "a more or less solid article of confectionery made by boiling sugar or molasses to the required consistency and then crystallizing, moulding or working it into the required shape. It is often flavored or colored and sometimes contains fruits, nuts, etc.," and this paper deals with the commercial manufacture of candy in factories of greater or less extent.

History.

"Candy" has probably been made from the time when the human race first learned the art of cooking, and undoubtedly has been manufactured in a commercial way from the earliest ages. In the past the making and selling of candy used to be part of the business of druggists, but in the early part of the last century candy manufacture became a separate business. Of late years the candy trade has increased greatly, and there are now many very large factories of modern construction used for this purpose only, equipped with latest improvements in power, etc.

Magnitude of the Trade.

The latest available figures taken from the U. S. Census Bulletin are not later than the year 1909.

CANDY FACTORIES

	1909	1904	Increase in 5 yrs.
No. of establishments	1,944	1,348	596
No. of wage earners	44,638	36,239	8,399
Wages paid	$ 15,615,388	$ 11,699,257	$ 3,916,131
Cost of materials	$ 81,150,773	$ 48,810,342	$ 32,340,431
Value of products	$134,795,913	$ 87,087,253	$ 47,795,913

It is probable that the increase up to the present year (1916) has been in equal proportion.

In the production by states, New York was (1909) the largest producer, followed by Massachusetts. Pennsylvania and Illinois are respectively third and fourth. Since 1909 there has been a considerable increase in Western producers.

CHOCOLATE AND COCOA

	1909	1904	Increase in 5 yrs.
No. of establishments	27	25	2
No. of wage earners	2,826	2,090	736
Wages paid	$ 1,268,613	$ 821,851	$ 446,762
Cost of materials	15,523,060	9,722,555	5,800,505
Value of products	22,390,222	14,389,699	8,000,523

Increase up to 1916 has probably been greater.

CANDY MANUFACTURING.

Description of Manufacture.

a. The varieties of candies sold are very great, every manufacturer having special products, and every district having local names, but in general candies may be divided into the following main classes, all varieties coming under one or other of these heads:

Hard Candy, including stick candy, Christmas candy, peanut candy, "Machine Drops," etc.

Chocolate Work, including "centres" composed of fondants, fruit, nuts, creams, nougat, hard candies, etc., and coated with chocolate.

Lozenges are cut from a paste by a die in the shape of thick or thin candies which may be either plain or printed.

Nougats, including cakes of sweetmeats, often containing almonds, nuts and usually sold wrapped in paper.

Sherbets, including fudges, cocoanut candies, taffies, etc.

Gum work including gum drops, etc.

Marshmallow of various kinds.

Pan work — candies in which a centre of some shape of sugar, nut or seed is coated and finished in a revolving pan.

Caramels.

Practically every form of commercial candy will come under one of these classes, the differences being due to flavoring, shapes and method of packing.

Raw Materials.

b. How they are usually received by candy manufacturers.

Materials used in composition of candy:

Sugar in granulated form in barrels.
Maple sugar in cans and tubs.
Corn Syrup or Glucose in barrels and cases.
Gelatine in barrels or cases.
Molasses in barrels.
Butter in tubs.
Gums in barrels and cases.
Chocolate in cakes packed in bags and cases.
Cocoa butter in cakes packed in cases and bags.
Vinegar in barrels.
Nuts in barrels and bags.
Crystallized fruits in boxes and cases.
Fruits in cans.
Flavoring extracts in cans and bottles.
Flavoring herbs, seeds, beans, etc., in boxes, bags and cases.
Eggs in cases.
Milk and cream in cans and dried in cans.

Alcohol in barrels.
Honey in barrels and cans.
Acetic acid in cans.
Cream of Tartar in cans.
Salt in barrels.
Coloring matters in cans.
Other less important articles.

Acessory materials, including packing materials:

Flour in barrels.
Starch in barrels.
Paraffin waxed paper in cases.
Paraffin wax in cases.
Cotton wadding in bales.
Excelsior in bales.
Paper boxes, fancy paper, ribbons, gelatine paper, tin foil, etc.
Wood boxes, wood pails.
Tin cans and glass jars.

Adulterants are now practically abolished from the class of candy factories that this article deals with, but are probably still used to a certain extent by smaller and less reputable concerns.

Adulterants are of many kinds but since (with the exception of shellac) they do not introduce any peculiar hazard into candy making they will not be noticed here.

(Note. — Shellac was not considered as an adulterant proper by the Government).

Candy Making.

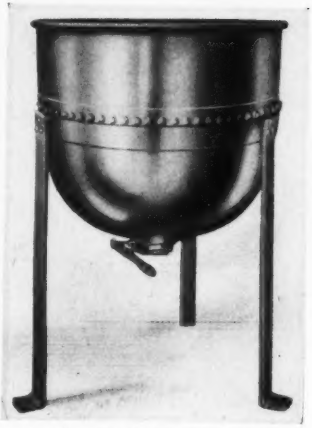
c. In general candy making constitutes the submitting of the raw stock, of which sugar, glucose, starch, chocolate and flavoring and coloring matters are the principals, to various degrees of heat, and to subsequent cooling, shaping, and packing the cooked result. Sugar, which may be considered the basis of all candies, takes different physical conditions according to the temperature at which it has been cooked. Names are given by candy makers to these physical conditions as follows:

"Small Thread"	when	heated	to	215°	F	and cooled.
"Large Thread"	"	"	"	217°	F	" "
"Pearl"	"	"	"	220°	F	" "
"Large Pearl"	"	"	"	222°	F	" "
"Blow"	"	"	"	230°	F	" "
"Feather"	"	"	"	232°	F	" "
"Soft Ball"	"	"	"	238°	F	" "
"Hard Ball"	"	"	"	248°	F	" "
"Small Crack"	"	"	"	290°	F	" "
"Crack"	"	"	"	310°	F	" "
"Caramel"	"	"	"	350°	F	" "

There are probably as many different ways of making the various kinds of candies as there are manufacturers, each differing in details, but the following description outlines the main methods employed by most.

In the processes of making candies included in the list given under *a*, the first is generally the cooking of the sugar, glucose and principal ingredients, and this is done in copper or brass kettles heated by steam in the more modern factories, but also by coal, coke, or gas. In the steam-heated

kettles the temperature required is regulated by the pressure of the steam. These kettles are not of high value. Vacuum kettles are also used, being enclosed kettles from which air and steam can be exhausted by power-driven air-pumps during the process of cooking. Vacuum kettles range in value from about $500, for the small machines, up. The use of the vacuum kettle permits of the use of a larger proportion of glucose, reduces the water constituents and reduces the time required in cooking. Boiling in vacuum kettles is done under vacuums of twenty-six to thirty inches.



Cooking Kettle, Steam Jacketed

During the process of cooking various means are used to prevent crystallization on the sides of the kettle, to prevent too rapid melting and to regulate changes of temperature. Ingredients are stirred or not, flavorings are added, etc., according to the result required. Kettles with mechanical stirrers are used.

When the cooking process is complete the material is removed from the kettles and is treated in various ways as follows.

The cooked batch is usually poured on to a marble-topped table with movable iron edges and allowed to cool. Sometimes iron tables containing a cold water circulation are used.

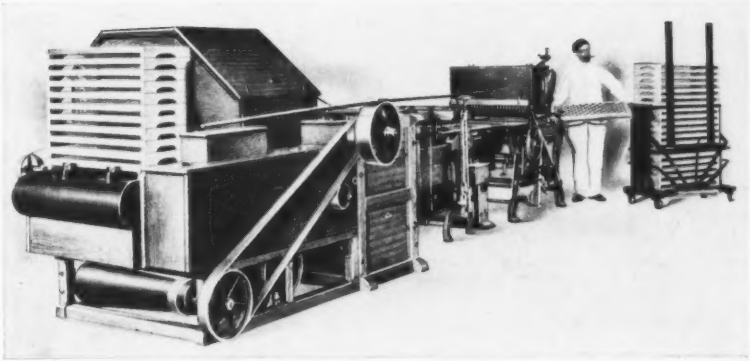
Hard Candy.

Temperature of cooking up to 320 degrees.

To make stick candy and the various kinds of Christmas candy, drops, etc., the cooked mass in a stiff dough or paste is placed in front of a heater on a "hard candy bench" where the heat gives a gloss to the surface and keeps the mass warm while it is being rolled out by hand into rods about one-half inch diameter, which are cut up into short lengths, allowed to cool, wrapped in paper and packed.

To make "drops" the hard candy while warm is rolled by hand into rods and passed through small brass rollers which have impressions cut in them and which shape the candy into "drops," these are then placed in trays and allowed to cool.

The hard candy bench is a long wooden table at one end of which is an arrangement for providing a considerable heat by direct radiation. This is usually a gas stove with asbestos radiators. The table is sometimes covered with canvas, and the candy is placed on the canvas in front of the stove and worked out. High pressure steam pipes are sometimes used instead of gas for heat, but some manufacturers consider that sufficient heat from steam pipes cannot be obtained for some classes of hard candy.



Machine for Making "Centers," etc.

Chocolate Work.

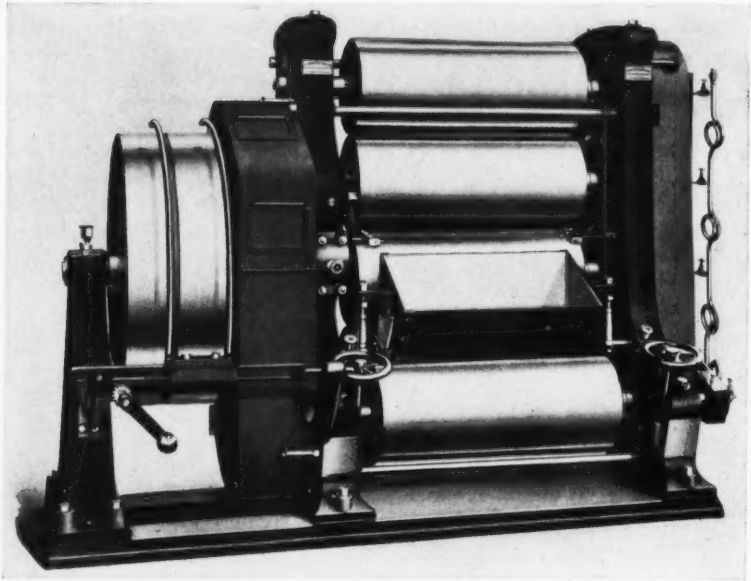
This includes the making of "centres" afterwards to be coated with chocolate.

"Fondants" and creams are cooked, and in some cases are then worked up to the proper consistency in mixers or beaters. After this they are cast in moulds. This is done by filling shallow wooden trays with starch. Impressions are made in the starch with patterns usually made of plaster of Paris. The material is then poured into the moulds and the trays are set aside to allow the cast centres to harden, which is done at the ordinary room temperature. When the centres are sufficiently hard the trays containing starch and centres are turned out, the starch sifted away, and the centres brushed to free them of starch powder. They are then ready to be coated with chocolate.

The filling of the moulds is sometimes done by hand, but the modern method is to do it by a machine that allows the right amount of material to fall into each mould. A machine is now largely used which combines all the processes. Wooden trays are fed into the machine, which fills them with starch, impresses the patterns, and fills the moulds. The trays are then taken off to be set aside for hardening, and when ready are returned into the machine which separates the "centres" from the starch and discharges them ready for coating, the starch going again to fill the trays for further use.

A machine of this kind known as a "Mogul" is here shown. When made of wood it is of about $2,500 value, when made entirely of steel, $4,000. Centres to be coated with chocolate are of great variety, almost all kinds of candy when in small pieces, as well as nuts, almonds, etc., being used.

Rooms where centres are made have large spaces for the storing of trays containing starch and centres. These are piled up one on the other,



Chocolate Refining Machine

each pile often being on a truck to allow of easy moving. Centres take from a few hours to several days to dry.

"Bon-bons" which are sometimes used for "centres" are made with some fruit nucleus, which is dipped into pans containing variously flavored and colored creams. These pans are often kept warm by gas, steam or hot water.

Coating of centres with chocolate is done in several different ways. The chocolate is obtained from the chocolate manufacturers in cakes, which are broken up and melted in a hot water heated mixer, temperature required 100 to 110 degrees F. Centres are placed by hand on a traveling belt which carries them up to the coating machine, then a wire traveling apron takes them through the machine where warm liquid chocolate is poured over them and forced up under them and the excess of chocolate is blown off just as the coated centres leave the machine. They then are automatically transferred to a traveling belt carrying waxed papers which carries them, passing through a partition, to the cold room, kept at about 65 degrees F., where the coated centres on the papers are taken from the belt and set on trays to harden. The waxed papers are returned and used over and over again. The coating machine is essentially an apparatus for causing a stream of warm liquid chocolate to cover the centres and provide a current of air to remove the excess of chocolate, at the same time

heating and mixing the chocolate. The chocolate is first melted and mixed in steam heated kettles and fed to the coating machine as required.

Coating is now chiefly done by machine. In the "Basket" machine, centres are placed in revolving wire baskets which are dipped into melted chocolate and lifted out and set to dry.

The modern machine such as the "Enrober" is largely used. The machine is located in a warm room, and is heated with steam, an auxiliary gas heater being used at the start.

Coating machines cost about $2,500, and with attachments about $1,500 more.

Hand Coating.

This is used when a peculiar style and result are desired for the coating of certain pieces which cannot be covered in a machine. Chocolate is melted in large melters as for the machine work and then pots are filled with the melted chocolate and kept at a temperature from 80 to 90 degrees by steam, gas or electric heat. These pots are usually set in the centre of large tables, at each side of which girls sit, the girls take the "centres" one at a time, dip them in the melted chocolate by hand and set them on waxed papers to dry. Sometimes nuts, etc., are placed on the tops of each while the chocolate is soft.

Lozenges, etc.

Materials for such candy are not cooked but worked up into a dough in a cold state. The dough is then passed into a machine which rolls it out into a thin layer and stamps out wafers, etc., which are dried and hardened on wooden trays in the ordinary room temperature. Goods when dry are packed either in rolls, packages, cartons, or barrels.

Nougats, etc.

Are cooked in the usual way and when hot are poured out onto marble slabs, allowed to cool and cut into pieces and wrapped. Occasionally nuts, almonds, etc., are mixed in, which is done on the marble slab when the hot material is poured out.

Gum Work.

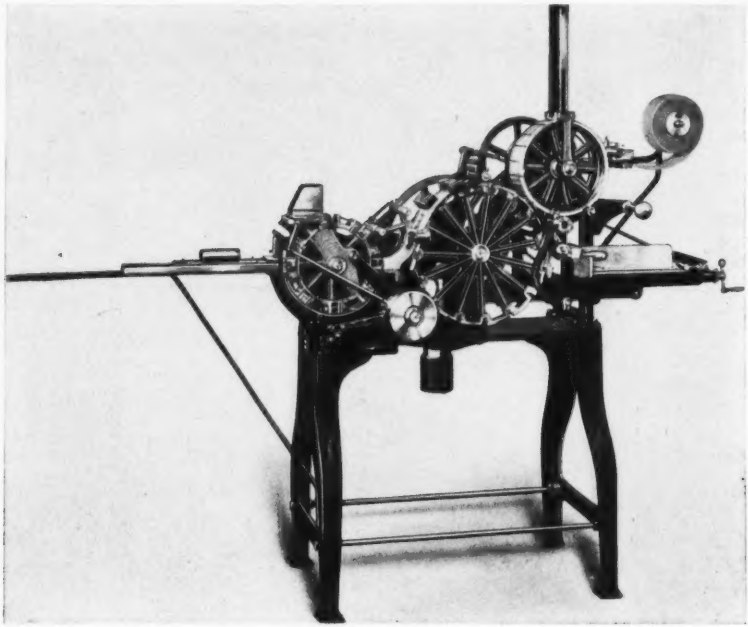
After cooking, gums are usually cast in moulds, in starch by hand or "Mogul" machines, and the trays of starch with the gums in the moulds are put into dry rooms. A heat of about 160 degrees is required for three to four days in the dry room to obtain the required state. Temperature up to 200 degrees is said to have been used, but most manufacturers consider this two high.

Dry rooms are steam-heated enclosures into which the trays, piled on trucks, are run, and temperatures are watched and regulated.

Marshmallows are manufactured in a similar way to gums, are dried in dry rooms at about 110 degrees F., and require two days to dry.

Pan Work.

Nuts, almonds, etc., are blanched, roasted or prepared in various ways and put into revolving pans; various prepared syrups and sugar are then poured on to the nuts as they revolve and tumble together; each



Wrapping Machine

becomes coated in a uniform manner, and more syrups are added according to the thickness of the coating required. Sometimes these coated nuts are polished by tumbling them in revolving pans which are lined with a thickness of strong beeswax.

Roasting and Preparation of Nuts.

Various kinds of nuts, almonds, etc., are used as centres for chocolates, Jordan almonds, and for mixing with nougats and various kinds of candies.

Peanuts are roasted and deprived of their husks and skins before being used. In roasting, the peanuts are placed in revolving drums and revolved over gas, coal or coke fires at a considerable heat. There are machines for roasting of various sizes, but it is common to roast about 160 to 300 pounds at a time, requiring about 25 minutes. Roasters usually have chimneys attached to remove the smoke. When roasting is completed the nuts are run out onto iron trays to cool, sometimes being cooled by exhausting cold air through them as is done with roasted cocoa beans.

Peanut skins are removed in a "blanching" machine, in which the roasted nuts are brushed against a corrugated plate; the brushing removes the skins which are then blown to a bag and fall into a barrel. Skins are useless and are usually burned.

Miscellaneous Machines.

Besides the machines already mentioned there are a number of others used in different stages or processes of candy making.

Pulling Machines are used to draw out and work up candy material in its soft and warm state, and give it an opaque texture by the admixture of minute bubbles of air. They are power driven machines with two revolving arms on which the material is wrapped or hung, and by continuous wrapping and winding mixes the candy with air. These machines are of moderate value and not easily damaged.

Wrapping Machines.

These are for mechanically wrapping candies in papers, tinfoil, etc. There are a number of makes and all are of a highly complicated mechanism and are very susceptible to fire, water and smoke damage. They are of high value ranging from about $700 to $3,000.

Bolting Machines.

These are for sifting and cleaning the starch used as a matrix in casting "centres," etc. Although the starch is used again and again it is necessary to sift and clean it periodically, about two or three times a year according as it is used. The machines are simple mechanical sifters, largely made of wood, and of small value.

Sugar Pulverizing.

Candy makers often do their own sugar pulverizing. High speed revolving disintegrators are used. The pulverized sugar is blown to a cyclone separator, and the fine dust passes on and is collected in canvas bags.

Cream and Marshmallow Beaters.

Enclosed machines in which revolving arms beat up material to the desired consistency.

Depositors.

Machines for depositing the right amount of material into moulds.

Decorating attachments for depositing decorative lines of chocolate or sugar on the outsides of chocolates or other small candies. They are usually worked as an attachment to chocolate coating machines, and are of considerable value.

Cutting Machines for slicing or cutting up such candies as nougats, etc. Not of high value.

Hand Rolls for making "drops" with variously cut rolls.

Packing Tables.

Tables arranged with traveling belt in centre.

Various Machines for crushing, cutting and blanching nuts, almonds, etc. Some of these machines are of considerable value and are readily subject to damage.

Packing.

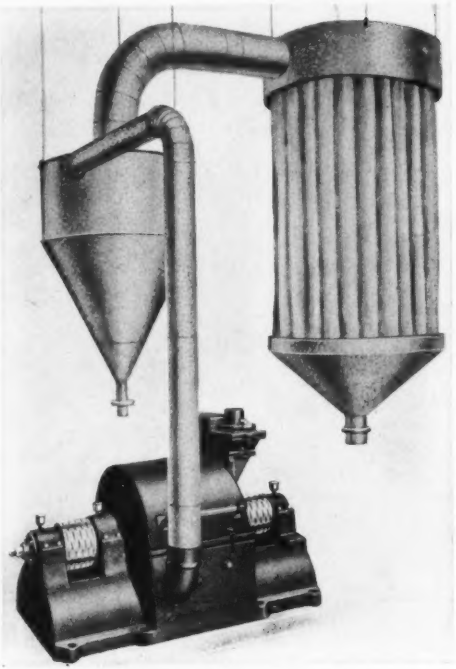
Candy is usually packed in paper boxes holding 1 to 10 pounds of candy, but the cheaper sorts are often packed in wooden cases and wooden pails, etc., holding larger quantities.

The higher priced chocolates are packed by hand, ornamental paper, gelatine paper, ribbons and thin fine cotton wadding being used.

The paper boxes are packed in large wooden cases with wood or paper excelsior for shipment.

Paraffin waxed paper is largely used in packing.

Chocolate packing rooms are kept at a temperature of about 60 to 70 degrees F.



Sugar Pulverizing Machine and Dust Catcher

Refrigerating Systems.

Finished candy, particularly chocolate work, must be kept at an even moderate temperature and some form of refrigeration is necessary to keep rooms at a sufficiently low temperature in summer. Brine cooled by expanding ammonia or direct expanding ammonia is circulated in pipes, usually placed near the ceiling, the ammonia compressing plant being in the power house. Sometimes air is cooled by drawing it through coils of brine or direct ammonia pipes by fans and discharging it in the rooms where the temperature is required to be lower.

Miscellaneous Accessories.

In packing and arranging candies for the market, decorations and novelties may be used, and though as a rule these are of a non-hazardous nature, such things as "Sparklers" have been used as sticks for "suckers" or "lollipops." These sparklers are iron wires coated with a mixture of iron, aluminum, barium and organic matter, which will ignite easily and burn while throwing off showers of incandescent sparks, and giving off a thick fume. Sparklers may be stored in wood and paper boxes containing up to 50,000. In cheaper classes of candy sold in "Lucky" or "Prize" packets, small novelties are sometimes included, and celluloid articles may be used.

Arrangement of Candy Factories.

Generally processes will be so arranged that the first processes are done on the upper floors, and will proceed downwards. Hence cooking kettles, vacuum pans, sugar pulverizers, depositors, starch, moulds, dry rooms, hard candy benches, nut roasters, and machinery will be located in the upper floors of candy factories. Chocolate coating, wrapping and cutting and the accompanying machinery will be on floors below, packing and finished goods below these. Storage of sugar, glucose, chocolate, etc., is often located in basements, where also refrigerating plants will be.

The larger modern candy factories frequently have auxiliary departments for manufacturing paper and wood boxes, also printing plants for printing wrapping papers, advertisements, etc. When such is the case extra special hazards will be introduced into the factory, but these will not be considered here.

CHOCOLATE AND COCOA MANUFACTURING.

Chocolate and cocoa are the products of the cocoa bean, which is the kernel or seed of the "Theobroma Cacao," a tropical tree of the order Sterculiaciae of the family of Buettnericae, and is indigenous to tropical Central America from Mexico to Brazil. It is now cultivated in various tropical regions, in Africa, Asia, West Indies, etc. The chief supply to this country comes from Central America.

The bean grows in the centre of large pods, which are gathered when ripe, and submitted to a process of fermentation or "sweating," the beans then separated from the pulp of the pods by washing, dried and packed in bags containing 140 to 200 pounds each, on the plantations, and are then shipped to the markets.

During the year ending June 30, 1913 (the latest available figures) there were 139,885,843 pounds of cocoa beans valued at $17,381,980 imported into the United States.

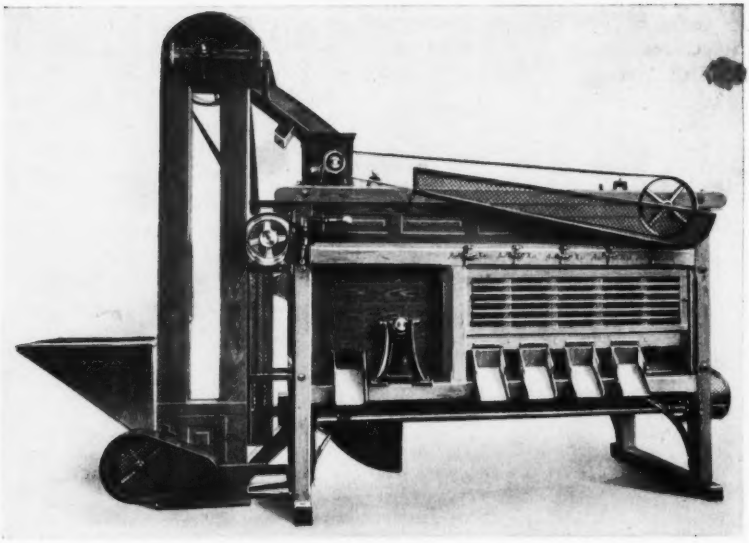
On arrival at the factory cocoa beans are stored in the original bags, some factories having large storehouses where there may be high values in crude beans. It is common to store bags of beans on the top floor of the factory, the processes of manufacture progressing downwards to take advantage of gravity. Beans in bags are easily damaged by water. When beans are wet a fermentation begins which quickly ruins them for chocolate manufacturing.

Sorting and Cleaning.

The beans are passed through sorting and cleaning machines, which sift out dirt and dust and remove the smaller and misshapen beans, and are fitted with magnets to remove particles of iron. These machines are largely of wood and are not of great value. Some of the more careful manufacturers submit the beans after coming from the machines to an inspection where girls pick out faulty beans by hand.

Roasting.

The beans are then roasted in roasting machines heated by coal, coke, gas, hot air or steam. The more modern method is to use gas or steam.



Cocoa Bean Cleaning and Sorting Machine

The beans are placed in a mechanically operated revolving drum and heated externally to a temperature of about 280 degrees F., for from one-half to one and one-half hours according to grade of product required. The roasting alters the volatile oils, changes the color, makes the starch soluble, causes other chemical changes and dries the husk of the bean. When roasting is completed the beans are discharged from the roaster into large trays or wagons and cooled rapidly by exhausting cold air through them by means of a fan. About 300 pounds are usually roasted at one time but sometimes more.

Roasting machines are essentially horizontal metal drums capable of being slowly rotated while being heated, which allows the beans to roast in a uniform manner without letting them come in direct contact with flame. The gases from the roasters are sometimes led away to chimneys. Values of roasting machines are not high.

Nibbing, Husking and Winnowing.

After roasting the husk of the bean becomes dry and brittle and will readily separate from the inside or "nibs" of the bean. The roasted beans are passed through rollers which crack the husks, and then through winnowers which separate the husks from the nibs. This latter is done by a current of air and the husks are blown to a receiver, or sometimes direct to boiler fires to be burned. In the manufacture of the poorer grades of chocolate the husks are not removed. There is a small market for husks alone, and for this they are packed in paper boxes, or they are sold in bulk to be used as fertilizer.

Chocolate Mill

After the removal of the husks the nibs are sometimes roasted again, and after being cooled are allowed to remain in heaps on concrete floors; this has an effect on the color.

Winnowing machines are mostly built of wood and are not of a high value.

The "germ" of the kernel which is a small hard woody particle is removed in an arrangement of shaking screens or sieves, or in a machine which separates the germ from the nibs by currents of air. The germs are useless and are usually burned.

The roasted kernels or nibs then go to the milling machine to be ground. A heavy stone of granite is made to revolve on a horizontal bed of similar stone in which corrugations are cut, and the nibs are fed in through a hole in the centre of the upper revolving stone. A mill has three sets of stones, the chocolate flowing from one set of stones to the next stone. These stones are heated with steam or hot water and kept at a temperature of about 110 degrees F. Milling machines vary in size and are of considerable value. They are heavy and floors where milling is done are often loaded to capacity. The ground nibs issue from the milling machines as a viscous fluid, and from this product chocolate or cocoa is made. The product from the milling machines contains about 50 per cent of fats in the form of cocoa butter, and by the removal of a portion of this cocoa butter cocoa is made.

The cocoa butter is separated by presses. Presses are operated by hydraulic power, pressures up to 700 tons per square inch being used, and 60 per cent to 70 per cent of the cocoa butter is pressed out. The presses are heated by steam and kept at about 100 degrees F. Cocoa butter comes from the presses as an oil and is run into pans, sometimes being filtered through flannel first and allowed to cool. It is sold in cakes weighing about 10 pounds and is used by druggists, candy makers, and others for various purposes.

At ordinary temperatures cocoa butter is a waxy solid melting at about 90 degrees F. The cakes of pressed cocoa from the presses are pulverized, sifted and cooled in rooms at a low temperature and packed in canisters. Pulverizing is done in a disintegrator, which is a closed steel vessel with revolving steel arms inside, or by passing the material through

steel rollers, or sometimes through beaters. During the process of pulverizing any flavoring matters and sugar required are added. A system of cocoa treatment known as the "Walker Patent Process" blows the cocoa from the disintegrators and by means of fans the cocoa is passed through and collected in a series of cyclone separators and metal tubes in a room kept at a low temperature, the cocoa is then sifted through muslin sifters and packed in canisters. This process is said to affect the color, etc., of the cocoa. Cocoas are sometimes treated with salts of soda, potash or ammonia to make them more soluble.

When chocolate is manufactured the fluid from the mills is treated in a series of machines for refining and conditioning. After coming from the mills the liquid is mixed in "Melangeurs" which have large circular rotating beds on which heavy steel or granite rollers revolve. Sugar, flavoring matters, milk-powder, etc. are here added if required. The chocolate is then "refined" on horizontal rollers which are heated and cooled by hot and cold water. This process is repeated several times, the chocolate sometimes being allowed to "rest" between refinings in warm rooms. At the end of the refining process the chocolate is usually cold and stiff, and is then reheated in mixers to be moulded. Melangeurs and refiners are of considerable value, and are heavy machines.

Chocolate is moulded in various ways. Iron moulds are warmed in steam heated closets and warm chocolate poured or pressed into them and the moulds are placed in a cold room where the chocolate hardens in a short time and is ready to be shaken out of the moulds when it goes to be packed or stored. When the moulds are charged they are sometimes placed on shaking tables which settle the chocolate and remove air bubbles. Depositing machines for making small chocolate drops which will also insert nuts, almonds, etc. are used, and the drops are carried on a traveling and shaking belt into cold rooms. Arrangement is used to carry filled moulds into the cold room and return the empty moulds which are warmed on the return journey by gas jets.

Various forms of wrapping machines are used in chocolate work similar to those used in candy wrapping.

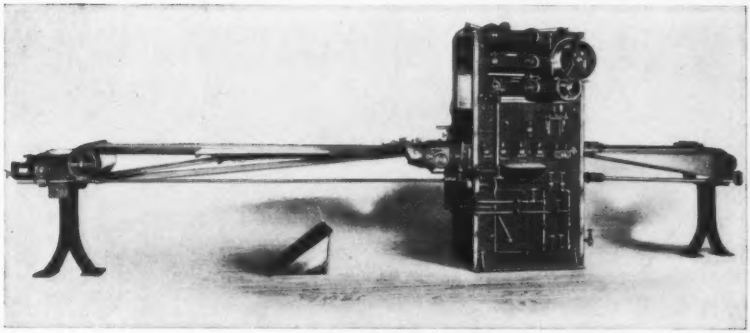
Packing and shipping of chocolate and cocoa is similar to ordinary candy work. Cocoa canisters and jars are filled by hand, on shaking tables, or by automatic weighing machines. These latter are delicate and expensive machines.

Other machines are sometimes used, such as air extractors, to remove air bubbles from chocolate paste before it goes to the moulds, presses for making chocolate wafers, mixing kettles, and tempering machines for imparting the right temperature to large amounts of chocolate paste before moulding or depositing.

Sugar pulverizing is often done by chocolate manufacturers, as described in Candy Manufacturing.

Arrangements of Processes.

The processes are usually located in chocolate factories from the top floors downwards as described.



Chocolate Coating Machine

The top floor may have a great weight in cocoa beans in bags. Sorting and cleaning machines are on the top floor; these machines are light. Roasters are on the floor next below, these are heavy; also husking and winnowing machines are on the roasting floor. Milling machines and presses are next below, and these are very heavy. Mixing, refining and moulding machines, also of great weight, will be below again; cold rooms and finished chocolate and cocoa butter storage rooms are often in basements. Packing is usually done on lower floors.

Packing, storage and cold rooms are usually refrigerated by pipes in which direct expanding ammonia or ammonia-cooled brine is circulated. Temperatures of cold rooms are kept at 50 to 60 degrees F.

SPECIAL HAZARDS OF CANDY MANUFACTURING.

Raw Materials.

There are no important hazards in the storing of raw materials, except that alcohol in large quantities should be stored outside in proper oil houses, and any highly inflammable novelties, such as "sparklers" should be kept in small quantities. Practically all raw materials here mentioned are inflammable and highly susceptible to water and smoke damage.

Cooking and Roasting.

Cooking kettles, vacuum kettles, candy furnaces and nut roasters, should be considered as low grade furnaces. Floors and ceilings should be incombustible, and kettles should have hoods over them, and coal and coke furnaces provided with proper flues. Where steam is used to heat kettles there is little hazard other than that incident to steam pipes. Gas, coke and coal heated candy furnaces introduce a hazard of igniting the contents of the kettle should it boil over. Some old-fashioned cook stoves were not securely fixed, and there was danger of upsetting stove. Nut roasters and popcorn machines, gas or coal or coke heated, should preferably be in cut off fireproof rooms. In nut roasting there is liability of nuts and husks burning if over-heated. Skins and husks of peanuts should be collected in fire resistive bins or metal barrels. Ashes from coal and

coke fires should be kept in metal ash cans. Floors of cooking rooms become covered with droppings of sugar, etc., which should be frequently washed up. Small gas stoves should be firmly fixed with proper air spaces and flexible gas tubing never used. In mixing flavors, etc., alcohol is often used, and as limited a supply of alcohol as possible should be kept in the factory.

Starch bolting is accompanied by an amount of starch dust which may cause an explosive mixture, and should be done in enclosures without open lights. Dust should be frequently removed. Starch bolting rooms should be ventilated.

Dry Rooms.

In candy making dry rooms are kept to temperatures of about 100 degrees to 200 degrees F. Dry rooms should be of fireproof construction, cut off from other rooms, being usually steam heated. The steam pipes should be so arranged that combustible trays, racks, dust and rubbish cannot come in contact with them. All corners and spaces in and around dry rooms should be kept clean and free from combustible material. Dry rooms are sometimes heated by air being blown in through steam heated coils. When this arrangement is used thermostats have been installed in the dry rooms, connected with a switch controlling motor which operates the fan, and when heat rises beyond the desired temperature fan is automatically stopped.

Hard Candy Benches.

When made of wood the parts near the heating appliance should be covered with sheet tin or zinc, and the canvass covered table should have tin below the canvass. Where possible steam pipes arranged clear of woodwork should be used instead of gas jets and asbestos radiators.

Sugar Pulverizing and regrinding of sugar candies produce much dust of an explosive nature and should be done in dust proof enclosures ventilated and without open lights. Grinders and pulverizers should be fitted with magnets to remove particles of iron. Sugar dust should be frequently swept up and not allowed to collect.

Chocolate Coating Machines are heated by steam or hot water, but often have gas jets attached that are used for the first heating up. All gas jets in a room should be controlled by one valve so that all may be shut off when work is stopped.

Chocolate heaters for hand coating are heated by gas, electricity, steam or hot water; where electricity is used pilot lights should be supplied. Gas jets should be properly guarded from tables. There is danger from over heating chocolate pots.

Packing.

Hazards here are chiefly from large quantities of loose paper, paper boxes, sheets of cotton batting and wood and paper excelsior. Paraffin waxed paper is largely used. Excelsior and cotton should be kept in metal lined bins, waste paper should be kept in metal and covered barrels, gathered up frequently and baled.

Refrigerating Systems introduce a hazard in ammonia fumes, and brine circulation is preferable. Candies and chocolates are sometimes dipped in solutions in which alcohol is the solvent. Arrangements should be as for dip tanks for volatile oils and should be protected as such, with metal covers, in cut off or detached rooms without open lights.

CHOCOLATE AND COCOA WORK.

Special hazards are very similar to those in general candy making; bean roasters, dry rooms, sugar pulverizing and heating kettles and refrigerating systems introduce similar hazards. In bean roasting the beans when roasted are turned out into large trays which are connected to an exhausting fan to draw cold air through the beans to cool them rapidly and arrest the roasting process quickly. These fans should be connected to metal or brick flues, discharging outside the building, since hot or even burning particles of husks may be exhausted.

Winnowing Machines.

Husks should be blown to fire resistive bins or direct to boiler fires to be destroyed.

Milling, Mixers and Refiners have little hazards except those of steam pipes; milling machines, however, should not be allowed to run without a continuous supply of chocolate nibs as there is a danger of heating up the chocolate to igniting point.

Moulding.

Moulds may be heated in ordinary steam heated dry closets, but also may be heated by gas jets on traveling tables.

Cocoa grinding and sifting is accompanied with dust and should be done in ventilated enclosures free of open lights. In the Walker Patent process fans should be protected so that no hard matter likely to strike sparks in the fan can be introduced with the cocoa.

PROTECTION.

There is no part of a candy or chocolate factory that is not in every way adapted to be protected by automatic sprinklers. Locations where temperatures are high can be protected by automatic sprinklers of high fusing point. It is not necessary to have temperatures of cold rooms so low that dry pipe systems would be necessary.

FIRE RECORD.

From reports of 142 fires, since November,1898, the following notes have been made.

Causes.

Unknown	50 =	35.2%
Power, lighting and heating	29 =	20.4%
Miscellaneous (smoking, etc.)	16 =	11.3%
Rubbish	13 =	9.2%
Candy boiling	12 =	8.5%
Roasting beans	10 =	7.0%
Sugar pulverizing	9 =	6.3%
Dry Rooms	3 =	2.1%
	142	100%

If the unknown causes are eliminated there are: —

Common Hazards	58 =	63%
Special Hazards	34 =	37%
	92	100%
In sprinklered buildings	65 =	45.8%
In unsprinklered buildings	75 =	52.8%
Not specified	2 =	1.4%
	142	100%

From examination of 142 fire reports the following loss per fire in connection with sprinklered or unsprinklered buildings is noted: —

Sprinklered Fires.	Unsprinklered Fires.
34 fires, total loss, $87,940.	50 fires, total loss, $824,952.
16 fires, No claim.	7 fires, No claim.
16 fires, Reported as "Small".	6 fires, Reported as "Small".
3 fires, Reported as "Large".	3 fires, Reported as "Large".
	1 fire, Reported as "Total".
	6 fires, Reported as "Not known".
69	73

Considering only fires where losses are known or where no claim was made.

Sprinklered Fires.	Unsprinklered Fires.
50 fires loss total $87,940.	57 fires total loss $824,952.
or $1,759 per fire average.	or $14,473 per fire.

Average loss per unsprinklered fire is 8.2 times the average loss per sprinklered fire.

CONCLUSION.

A desirable candy or chocolate and cocoa factory from a fire protection standpoint will be on general lines as follows: —

Construction, reinforced concrete, tile partitions, with stair and elevator wells cut off in standard manner, and all floor holes, chutes, etc., automatically trapped, wired glass in metal frame windows against any exposure, floors waterproofed and scuppered. Where necessary, as in packing and chocolate-coating rooms, hard wood flooring over the concrete floors. Dry rooms, and roasting rooms, and hard candy bench rooms, sugar pulverizing, cocoa grinding and starch bolting rooms cut off. Power plant detached or cut off. Cooking, hard candy bench work, roasting, melting, all done by steam, refrigerating by brine circulation with ammonia plant cut off or detached. Electric light throughout with vapor proof globes and outside switches for sugar, starch bolting or cocoa pulverizing rooms. Basement well drained, all stock kept well skidded. Where the use of gas is necessary, all gas jets should be controlled by one master valve, where electric heating is done pilot lights to be in circuit. Standard watchman's service with stations in dry rooms.

Complete sprinkler equipment with alarm valve. Standard inside protection of pails or chemical extinguishers distributed in every room. Detached storehouse for any specially inflammable oils or other materials. All rubbish and sweepings deposited only in metal barrels with covers; cut off rooms for storage of excelsior.

Collapse of Tank Structure.

Special Report by New York Fire Insurance Exchange. (Member N. F. P. A.).

January 11, 1916.

Description of Building.—Building was twelve stories and basement high, of fireproof construction, and occupied by tenants manufacturing women's wearing apparel. Walls brick, steel skeleton construction; floors steel beams and girders with four-inch concrete floor slabs, wood finish, not arranged to drain; roof steel beams with four-inch concrete slab and twelve inches or more of cinder fill above to give pitch to roof; columns steel, protected by two inches of concrete. Building was erected in 1910.

Description of Tank Equipment.—Building was provided at time of construction with a wood house tank of 6,000 gallons capacity for hose and standpipe service, elevated about seventeen feet above roof on a steel structure. Steel structure consisted of an iron grid supported on four six-inch by six-inch angle iron columns resting on building columns. House tank structure was located on west side of building.

Pressure tank which is of 7,500 gallons total capacity is carried on one twelve-inch I beam and one twenty-inch I beam supported at each end by building column. This tank played no part in the accident.

Sprinkler tank was 10,000 gallons capacity, material cedar. It was carried on a newly constructed steel structure supported on the east by a twenty-inch I beam resting on the twelve-inch and twenty-inch I beams which also supported pressure tank and on the west by the old house tank structure. Accompanying sketches show arrangement.

It has been stated that plans for this new work which included installation of supports for pressure and gravity tanks for sprinkler system had received the approval of the Building Department, but that the department had not issued its final approval for the completed structure. The contract for the tanks and tank structures had been sublet to an engineering company which now builds tanks and tank structures, hose houses, valve houses, suction cribs, etc.

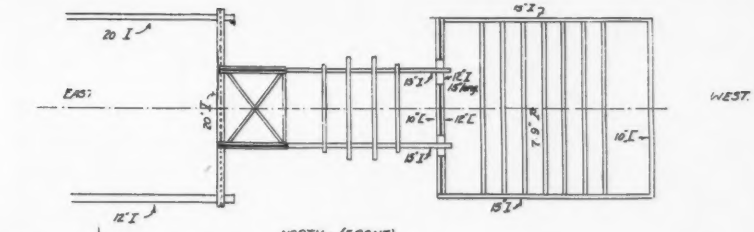
Account of Collapse.—At about two a. m. Tuesday, January 11, 1916, the tank structures collapsed, dropping sprinkler gravity tank and house tank and their contents, also part of tank structure, through the concrete roof and into the top floor. The only occupants of the building at that time were two night watchmen. It could not be learned what they did to prevent further damage, but apparently nothing. There was little that could be done. Fortunately the accident did not occur during working hours. It was stated that at least ten persons were employed in the portion of top floor into which tanks fell, and doubtless some of these would have been killed or injured. Building is typical of buildings of this class, a large number of operatives being employed, and doubtless a panic would have followed the accident.

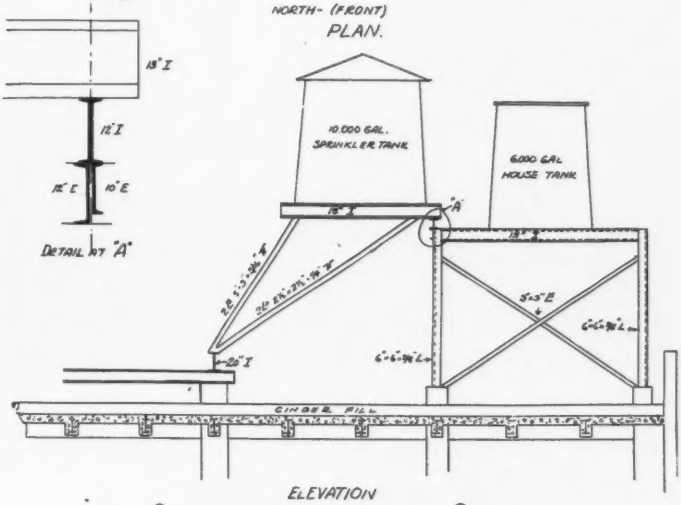
Installation of the sprinkler equipment had just been completed. It was stated that water had been carried in sprinkler gravity tank for about three weeks. This was confirmed by an inspector who left the tank full on January 10th. Final inspection was contemplated at the time. House tank was filled automatically by pump in basement and probably was full.

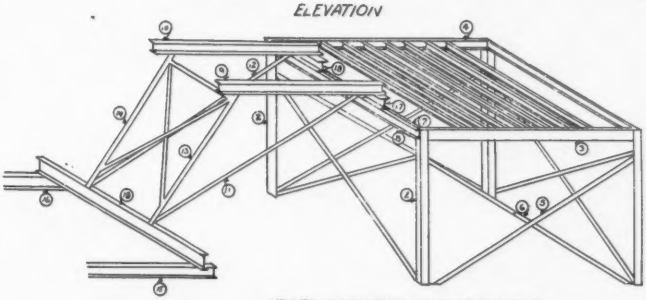
The sprinkler and house tanks which fell were of 10,000 and 6,000 gallons capacity respectively. In addition to the water contained in gravity tanks, the entire contents of the 7,500 gallon pressure tank were discharged into top floor by the breaking of sprinkler main.

The damage to contents on twelfth floor was practically total by water. On the eleventh floor the damage was considerable, and on the floors below to ninth was in a diminishing proportion, as much of the water ran down elevator shafts. The damage to tanks and tank structures was practically total. A hole was broken through roof about fifteen feet in diameter. One of the steel roof beams was knocked out, and adjoining beams and girders badly damaged.

Conclusions.—The steel of which the structures were built, though greatly deformed in some cases, appeared to be of good quality. There were no failures of the metal itself, and no signs of fracture of steel fibre, in spite of excessive deformation. The collapse was probably due to the failure of the two six-inch by six-inch by three-eighths-inch angles which





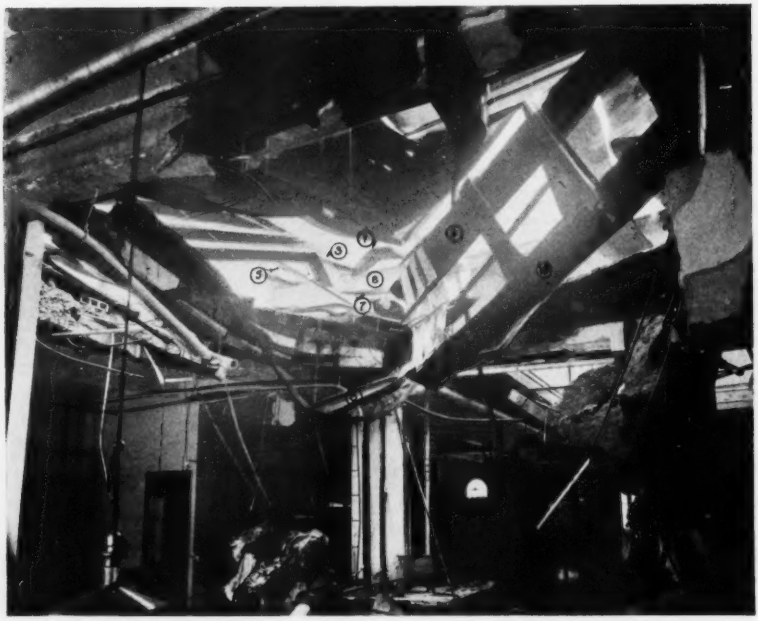


KEY TO NUMBERING ON PHOTOGRAPHS.

NOTE. Sketch does not attempt to show structural details, but general arrangement only.

SKETCH TO ACCOMPANY REPORT.
COLLAPSE OF TANK STRUCTURE.
140-144 WEST 22nd St., N.Y.C.
JANUARY 11, 1916.

AUTOMATIC SPRINKLER DEPARTMENT.
NEW YORK FIRE INSURANCE EXCHANGE.
H. ANDERSON.



supported the house and sprinkler tanks, inasmuch as calculation shows these to have been thirty-nine per cent overloaded and of excessive length in proportion to section.

The above mentioned engineering company in a letter to the superintendent of buildings under date of January 12, 1916, wrote as follows:

"The outfit was in the course of construction according to the approved plans of the Building Department, and the work was incomplete as the existing angle columns supporting the high ends of the truss had not been reinforced as specified on the plans, our material for this work being on the roof of the building. In addition to this certain ladders and platforms, to gain access to the tank, had not been completed.

"The collapse is due to the fact that the water had been turned into the tanks before the columns had been made strong enough to carry the load. We, as the architects and contractors for this work, had given no authority to anyone to place any load whatsoever on the structure, it being customary with this class of work for the tank contractor to turn the water into the tanks himself or at least to authorize the owner in writing to do so."

The general superintendent of the firm which installed the sprinklers stated to the insurance inspector that he was on the roof of the building at the time the sprinkler gravity tank was being filled.

Another possible cause, not capable of ready calculation, is the overturning of the twenty-inch I beam on the east end of structure due to thrust of members brought about through possible eccentricity of loading and defective workmanship. (It is notable that there was no member tying leg of new structure at east end and tending to prevent kicking out.)

4
3
1
2

3
5
6
9

In view, however, of the more apparent cause noted above, namely, the failure of the columns, this is hardly considered probable. Eccentricity of loading might also have occurred at the two twelve-inch I beams fifteen inches long bearing the sprinkler tank structure (shown at "A"). This would be caused by unevenness of bearing surface on the two channels or the difference in deflection of a ten-inch and twelve-inch channel under load. Calculation showed other members to have been designed strong enough for the loads applied.

The records of the U. S. Weather Bureau show no contributing factors due to the weather. The wind varied from fifteen to twenty-one miles per hour during the night, classed as gentle breeze to moderate breeze. Direction was southwest. Temperature was about thirty-five degrees F., and there was no sudden change, the variation being not greater than one degree per hour.

Prevention of recurrence is hardly a matter which can be handled under present conditions. It is plainly a case of placing responsibility for the filling of tanks on newly built structures. The final approval of the Building Department should be obtained in every case before filling of tanks. As a result of investigation it would appear that the combining of new with old structures for the support of tanks irrespective of service should be discouraged. Further, the use of metal less than five-sixteenths-inch, unless properly protected against corrosion, should be prohibited.

Department of Fire Record.

RESIDENCE FIRE FATALITY.

243 Hancock Street, Brooklyn, N. Y.

February 4, 1916.

Construction. This building was the ordinary type of dwelling, five and three-story and cellar in height, with a small blind space under the roof. It covered a ground area of 1,400 square feet. The walls were brick with brownstone front. The roof was metal on seven-eighths-inch boards joisted, with a tile-covered frame mansard at front. In the roof was a small skylight two and one-half by four feet, of thin glass on wood frame and located directly over the stairs; also thin glass in wood frame over a small vent shaft. The floors were part parquet on seven-eighths-inch and part seven-eighths-inch hardwood, joisted. All the ceilings were lime plaster on wood lath, except plaster board on part of cellar and the side walls were partly plastered direct and partly plastered on wood furring. The main stairs extended from cellar to the top floor and were open to halls except where enclosed in wood partitions with wood and glass panel doors to first and second floors; also one additional stairway from first to second floor in rear portion of building enclosed at first floor in lath and plaster partition with wooden door to kitchen on first floor. There was also one small bathroom vent shaft extending from third floor through the roof, enclosed in lath and plaster with thin glass sidelights in wood sash and frames on floors above third.

Occupancy. Basement — cellar purposes, storage of preserves, coal bins, one hot air furnace six by six feet diameter, on concrete floor, top twelve inches below metal-covered ceiling and having nine feet of nine-inch smokepipe eight inches below plaster ceiling connected to four-inch brick flue; air intake was all metal, heating pipes to four-inch brick flues in side walls, also up through partitions properly guarded and with ample clearance.

First floor — two kitchens, each with one coal range on concrete hearth and connected to four-inch brick flues; dining room, one open fireplace with tile hearth, not used.

Second floor — Parlor floor with a front and rear parlor (the latter was used and fitted up as a buffet room), two open fireplaces with tile hearths, not used.

Third floor — Sewing room and two bedrooms, two open fireplaces with tile hearths, not used, one gas heater.

Fourth floor — Three bedrooms.

Fifth floor — Three bedrooms and one spare room.

How Discovered. Shortly before 3 a. m. a daughter of the occupation awoke, and noticing smoke in her room at once telephoned the city fire alarm operator that the house was on fire. The operator did not procure the address and called up the telephone "information" department for the address of this telephone number. After the address was secured, fire headquarters was notified at 2.52 a. m. and a special call was sent to the nearest fire department company. The first alarm was received at 2.59 a. m. and when the fire department arrived a second alarm was rung in at 3.06 a. m.

Origin. Unknown. From the condition of the partition between the main hall and the front parlor it appeared that the fire started at this point. There was no evidence to indicate that the fire was of electrical origin and the equipment throughout was installed in accordance with the rules of safe practice. The occupants had been bothered by mice, due probably to food stuffs standing around, — as one of the occupants was an invalid. There is no evidence, however that mice were responsible for the fire.

Spread. The fire spread rapidly owing to the inflammable contents such as curtains and furnishings on the parlor floor and hall, and passed up through the open stairway to the upper floors.

How Extinguished. The fire was extinguished by the fire department. When the first apparatus arrived the front hall on second floor was completely enveloped in flames. Some delay and difficulty was experienced in gaining entrance as the front doors were massive and fastened with numerous bolts and locks. It was about two hours before the fire department had the fire under control.

Damage. The cellar and first floor were damaged by water and smoke only. The front portion of the second or parlor floor was mostly burned out and the partition where the fire was supposed to have started was badly burned. The contents of the front portion of the third and fourth floors were burned and the plaster from ceilings and side walls of these floors was down. Little of the contents of the fifth floor were burned, most of the damage being done by smoke and water.

Loss of Life. Six persons lost their lives in this fire; three were burned to death and three suffocated. The daughter who first discovered the fire assisted her mother (who was the only person saved) to the roof of the three-story extension. In attempting to save a sister, after assisting her mother to safety, this daughter lost her life. Both of the young women were found dead near the window through which the mother escaped.

Conclusion. The possibility that loss of life in this fire might have been prevented by the earlier arrival of the fire department, which responded to the first alarm from a street box, emphasizes the importance of giving serious consideration to all alarms of fire whether transmitted by street boxes, telephone or otherwise.

The inadequacy of exit facilities in high narrow dwellings with only one stairway (ordinarily forming a natural flue for the spread of fire) is obvious.

Report of Fire at Factory of William F. Taubel, Inc. Riverside, New Jersey, January 2, 1916.

By A. R. Ramsdell (Member N. F. P. A.).
Engineer, Office of Schedule Rating Expert, Newark, N. J.

Construction.

The buildings in which this fire occurred were known as Buildings No. 10 and No. 14 of the west group (See Fig. 9). Building No. 10 was a modern building, built in 1912, brick walls, heavy plank and timber floors and four stories and basement in height. The floor timbers were 12″ x 16″ hard pine, 8 foot centers, supported by wooden columns every 16 feet. Ends of beams rested on self releasing column and wall plates. Fig. 8 shows the effect of this construction after a destructive fire. Roof was of plank on timber, trussed (no columns) and well pitched as shown by contour on west wall in Fig. 8. This construction probably caused the walls to be pushed out when the roof fell in. The stair tower was of brick fire proof construction, cut off on each floor by standard self closing tin covered fire doors. Elevator was of brick, cut off on each landing by rolling steel doors. Windows on the west end were wired glass in metal sash protecting a fire escape and also the exposure from frame building. All other windows were plain glass in wood sash. Ground area 9750 square feet. The communications consist of an overhead bridge on the east end extending from the fourth floor across a 50-foot street into Building No. 6 of the east group. This bridge was steel frame, metal covered with a wood floor and cut off at each end by rolling steel doors. There is also a passage way of brick construction at the basement level leading into Building No. 5. This passage was not cut off or curbed. Building No. 14, which adjoins Building No. 10, and connects the space at the east end between Buildings No. 10 and 12, had been recently built. It was practically a roofing in between the two buildings consisting of light plank on wood trusses with a 6-foot lantern monitor. The low point of the roof extended along the window sills of Building No. 10. The windows communicating to Buildings 10 and 12 were plain glass in wood sash and were said to have been closed at the time of the fire. Ground area 2,500 square feet. Buildings No. 5 and 12 which were slightly damaged consisted of low one story, brick, plank on timber constructed buildings, the windows being plain glass and wood sash.

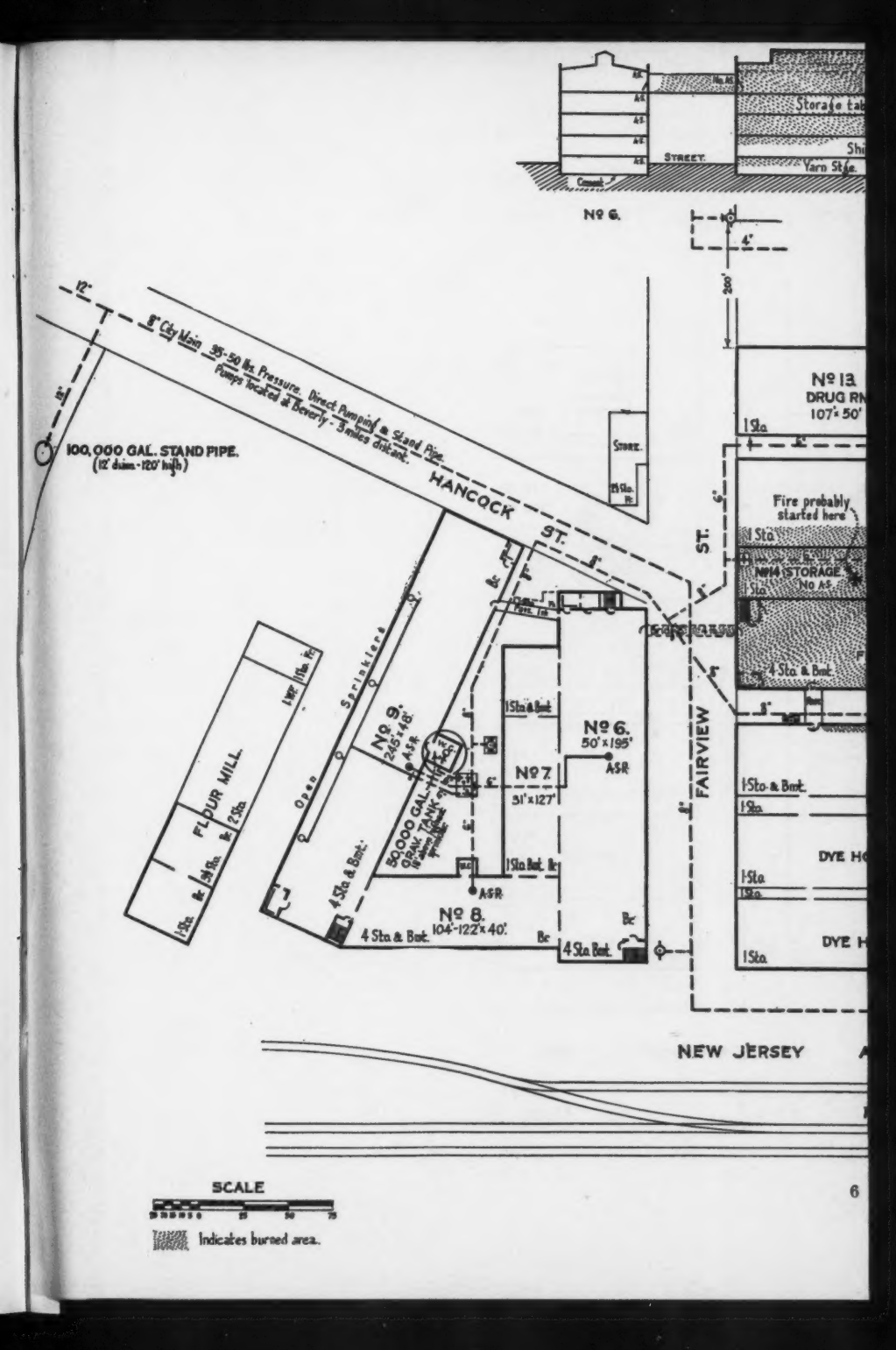
Occupancy.

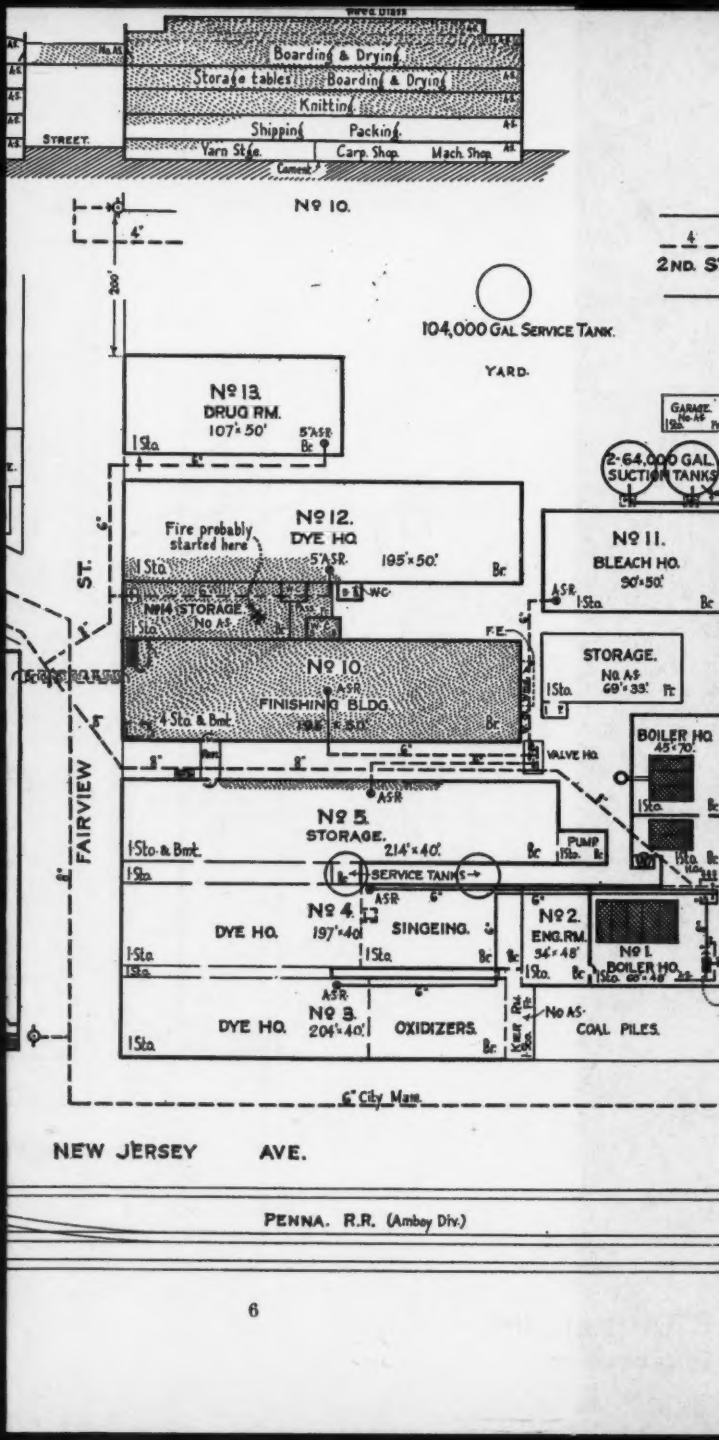
This concern manufactures a high-grade knit hosiery of cotton, mercerized cotton and silk, dyed and bleached, and has a number of mills throughout Pennsylvania and New Jersey which operated only as knitting mills. The finishing and shipping was done mostly at the Riverside plant, although a small amount of knitting was sometimes done. Building No. 10 was occupied as follows: — fourth floor, boarding and drying as is ordinarily done in horizontal cyclone dryers; third floor, a few dryers of a new type consisting of a steam heated aluminum shell onto which the stockings are drawn by hand. This was an experiment but if successful would cheapen the cost, doing away with the old board and dryer process and utilizing girls in place of men. The remainder of the floor was mostly vacant except for a lot of tables piled up near the south side of the east end or near the windows overlooking Building No. 14 . The second floor was occupied by the knitting process using circular machines, and the first floor carried a considerable stock of finished goods and also was used for packing and shipping. The basement was used for storage of coned yarn in cases, stock bags, etc., carpenter and machine shop.

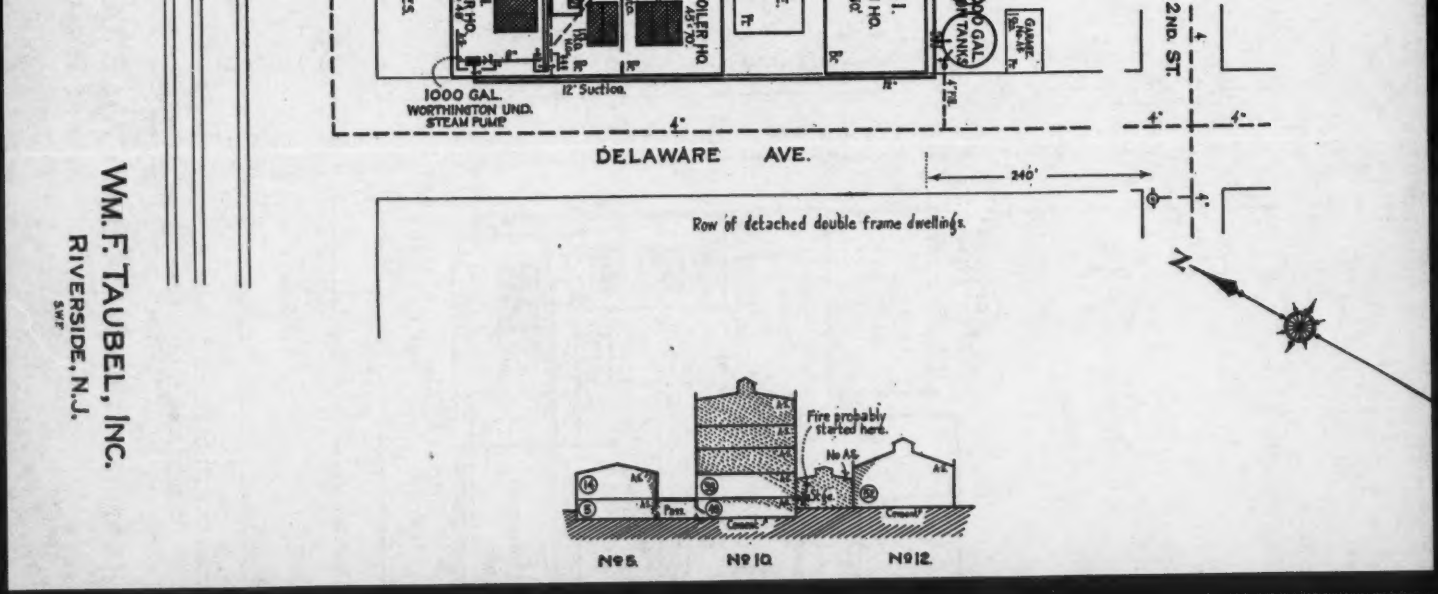
Building No. 14 is said to have contained trucks of hosiery in the grey to be dyed, some off color to be redyed and some going through the regular process, a hydro extractor and some empty trucks. Building No. 5 is occupied for the storage of stock in the open and Building No. 12 as a dye house. These buildings were only slightly damaged.

Protection.

Building No. 10 was equipped throughout with a modern system of automatic sprinklers, Manufacturers' Type C installed in 1912 on the wet pipe system with no alarm valves on risers. Pipe sizes 1905 standard, spacing 8′ x 11′-6″, all heads were upright, center feed. Building No. 14 was not provided with sprinklers, having recently been erected. Bridge to Building No. 6 and passage to Building No. 5 also were not sprinklered. The primary supply was from a 50,000 gallon gravity tank located on Building No. 9 and 18 feet above line of sprinklers in monitor in Building No. 10. The distance to the tank was more than is usually permitted, the run consisting of about 600 feet of 8-inch pipe (allowance in this length for fittings, etc.), and 100 feet of 6-inch pipe. The secondary supply was from a 1,000 gallon 18 x 10 x 12 Worthington Underwriter steam fire pump located in Boiler House No. 1 and taking suction from two 64,000-gallon tanks, total 128,000 gallons, situated above grade about 250 feet distant. The 8-inch discharge line from the pump was connected to the long run of 8-inch pipe from the gravity tank, all buildings were supplied from this main with mostly outside control. This layout was made when the plant was much smaller than at present, which makes the present fire protection weak for a plant of this size. The private hydrant system consisted of wall hydrant on the fire pump in Boiler House No. 1, and a two way hydrant between Buildings No. 5 and 10, for the west


No 6.
Storage tab
Yarn Stge.
STREET.
No 13
DRUG RN
107'x 50'
1 Sto.
Fire probably started here
No 14 STORAGE
No A.S.
4 Sto. & Bmt.
100,000 GAL. STAND PIPE.
(12' diam.-120' high)
8" City Main 35-50 lbs. Pressure. Direct Pumping & Stand Pipe.
Pumps located at Beverly - 3 miles distant.
HANCOCK ST.
FAIRVIEW ST.
Sprinklered
FLOUR MILL
No 9.
245'x 48'
A.S.R.
No 6.
50'x 195'
A.S.R.
No 7.
31'x 127'
50000 GAL. H
No 8.
104'-122'x 40'
4 Sto. & Bmt.
1 Sto. & Bmt.
DYE H
NEW JERSEY
SCALE
Indicates burned area.
6


Boarding & Drying
Storage tables
Boarding & Drying
Knitting
Shipping
Packing
Yarn Stge.
Carp. Shop.
Mach. Shop
STREET.
Cement
No 10.
4"
200'
104,000 GAL. SERVICE TANK.
YARD.
No 13.
DRUG RM.
107' x 50'
5' ASR
1 Sto.
No 12.
DYE HO.
Fire probably started here
5' ASR.
195' x 50'
1 Sto.
No 14 STORAGE
No A5.
No 11.
BLEACH HO.
90' x 50'
ASR
1 Sto.
STORAGE.
No A5
69' x 33'
No 10.
ASR
FINISHING BLDG.
4 Sto. & Bmt.
BOILER HO.
45' x 70'
VALVE HO.
No 5.
STORAGE.
214' x 40'
1 Sto. & Bmt.
PUMP
SERVICE TANKS
No 4.
DYE HO.
197' x 40'
SINGEING.
1 Sto.
No 2.
ENG. RM.
34' x 48'
No 1.
BOILER HO.
No 3.
DYE HO.
204' x 40'
OXIDIZERS.
No A5.
COAL PILES.
FAIRVIEW
ST.
6" City Main
NEW JERSEY AVE.
PENNA. R.R. (Amboy Div.)



WM. F. TAUBEL, INC.
RIVERSIDE, N.J.

Fig. 1

group. There is a single two way hydrant in the yard of the east group. These hydrants were fully equipped with hose, etc., but as can be seen by referring to Fig. 9 are in positions which make them unhandy and dangerous to use. Long lines of hose were necessary to cover the plant and only a few streams could be made effective.

The watchman service consisted of three men making rounds hourly at night. One man patroled the east group, one man looked after Buildings Nos. 3, 4, 5 and 10, while the third man was employed specially to watch Building No. 13 where there was a large amount of dyestuffs, drugs, etc. This man was also supposed to make occasional visits to Buildings Nos. 12 and 14 but since he had no clock it was impossible to tell as to the reliability of this service. This special service was put in force in recent months because of the scarcity and value of dyestuffs since the European war. The public protection consisted of a very scant hydrant protection from distant locations, only two hydrants being in close proximity. The supply was from a standpipe about 220 feet away from the east group. It was 12 feet in diameter, about 120 feet high and kept full by pumps located at Beverly, N. J., about three miles distant. There is a valve whereby the stand pipe can be shut off and allow the pumps to maintain pressure direct on the lines in case a fire should require it.

Normally we have a direct pumping system pumping against a stand pipe head and when the standpipe is full and not much drag on the system the pumps are stopped but are supposedly kept ready for an emergency. The public water supply is connected to the property only as a means of filling the suction tanks. The street mains in the vicinity with the exception of an 8-inch line which runs from Hancock to New Jersey Avenue, are 4″ x 6″ (see Fig. 9). Pressure varies from 35 to 50 pounds. Fire pumps at the Riverside Metal Company about two blocks away are

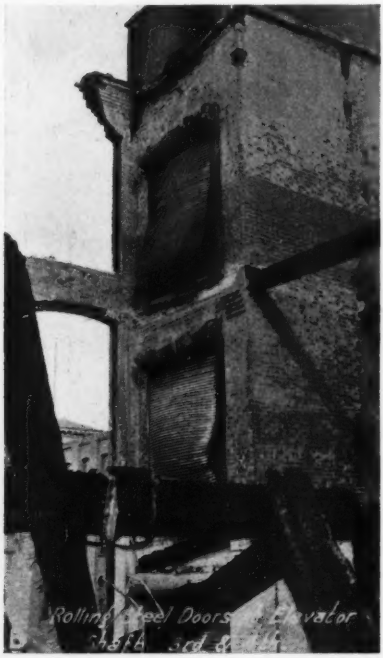


Fig. 2

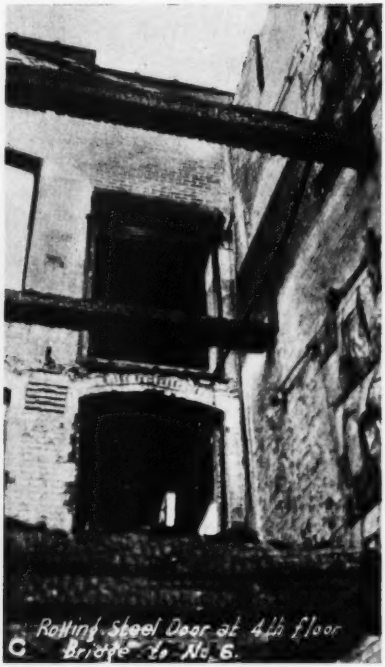


Fig. 3

connected to the public mains and were used at this fire to good advantage. There is a volunteer fire company about two blocks away, also several more companies in the neighboring towns which are available.

The Fire.

The story of the fire, as obtained from several sources, is somewhat conflicting in details, but condensed is as follows. It seems that about 12:45 A. M. on Sunday morning the fire was discovered by several persons outside, in various locations and also by the village night policeman about a block away, who immediately notified the fire department causing the ringing of the alarm bell. It is said and apparently recorded on the clock dial that the watchman rang up his station in Building No. 10 at 12:40 A. M., but this is not clear by the clock record, as it would have been an easy matter for this record to have been made on the night previous, since Saturday was a holiday and the clock dial had not been changed. It is hard for any one to explain how any person could have passed through the basement of Building No. 10 at this time without detecting a fire which on its discovery was of such magnitude. The watchman claims that he saw flames licking up the window frames and under the floor in

Fig. 4

Building No. 10, adjoining Building No. 14 while passing down the Building after his 12:30 round. He immediately ran around to the Boiler House Building No. 1 and notified the night fireman who evidently was confused or failed to understand and the fire whistle was not sounded for ten minutes or so after the public alarm was rung in.

The volunteer department responded immediately and two streams were placed in action, only to find that the pressure was feeble and not effective, which apparently showed that the standpipe was lower than usual. The pumps at the Riverside Metal Company were started and materially increased the pressure but could only reach the full standpipe pressure on account of the standpipe valve being left open. This valve was not shut except for a short period during the fire; the reason for not closing it at the start is unknown. The pumps at the waterworks in Beverly were not started promptly and did not seem to have much effect, probably because of the heavy draft and standpipe valve being open. The master mechanic arrived at the Boiler House shortly after the public alarm was sounded and found that the fire pump was not started. The night engineer was in the engine room apparently trying to throw in the night emergency light but the line evidently was damaged in Building No. 10 so as to be inoperative. The fire pump was finally started and three streams were put in service, one from the wall hydrant at fire pump and two from the hydrant located between Buildings No. 5 and 10. These streams were feeble because of the large number of sprinklers opening and probably the gravity tank was empty, due to the delay in starting the fire pump. About 1:45 A. M. the third and fourth floors of Building No. 10 and all of Building No. 14 were a raging furnace, the fourth floor of Building No. 10 fell which broke off the sprinkler risers, the top of the wall

Fig. 5

falling on the hose streams from the hydrant between Buildings No. 5 and 10. The 4-inch line from the public mains feeding the suction tanks was opened but probably could get but little water from the 4-inch main since all the volunteer companies were drawing on all the hydrants in the vicinity. It is said that twelve streams were in operation at one time but this was cut down later on account of the feeble streams. By this time it could be seen that the private protection was badly disabled and the fire pump streams could only be used to save the adjoining buildings, so aid was asked from Burlington and Camden which responded promptly with two pumping engines arriving about 2:45 A. M. With the increased pressure from the engines and the cutting out of a good many feeble streams the fire was under control about 4 A. M.

The second, third and fourth floors of Building No. 10 were entirely destroyed and all of Building No. 14 except a small part of the roof, as can

be seen in Fig. 1. The floors in basement and first floor east end of Building No. 10 were partly burned, probably after the sprinkler system was put out of commission. Buildings No. 5 and 12 were damaged by the fire to the extent of destroying the window frames, etc., the inside being damaged by water. Figures 4, 5 and 6, show general views from all sides of the burned section.

The condition of the wired glass windows on the west side of Building No. 10 should be noticed in Figs. 6 and 8. Except for a few small holes and the general cracking of the glass these windows gave remarkably good service.

The bridge on the fourth floor of Building No. 10 leading across the street into Building No. 6 was practically destroyed as shown in Figs. 4 and 5. It will be seen by referring to Fig. 3 that the rolling steel door in Building No. 10 failed to operate, evidently starting, but jammed, dropping about one foot. This enabled the fire to spread along the bridge, but was prevented from getting into Building No. 6 by another rolling steel door which may have operated itself or by someone seeing the danger of the fire getting into Building No. 6, and dropping it manually. The passageway leading from the basement of Building No. 10 into Building No. 5 being without any curbing allowed water to flood the basement of Building No. 5 causing considerable damage. The fire doors on the stair tower, as will be seen in Fig. No. 3, were self closing tin covered and were badly damaged but apparently held the fire from communicating up the stair tower. On the elevator shaft the rolling steel doors were badly buckled as can be seen in Fig. 2.

The destruction of the second, third and fourth floors of Building No. 10 can best be seen by referring to Fig. 8 which shows a good example of the action of self releasing floor timbers and the destructive effect on hard pine plank and timber construction. The first floor and basement were damaged by fire to some extent on the east end and the water damage was considerable. The total loss was approximately $244,000.

Causes of Fire.

There are several suppositions regarding the origin or cause of this fire; first, that of an incendiary. The question of moral hazard is absolutely eliminated since the assured are of a high class standing doing a large and successful business. It has been rumored that the new process of drying being tried out on the third floor of Building No. 10, would throw out of employment a number of the men employed on the old process of drying, but this is hardly probable since this concern is of large magnitude and no doubt could use all of the help that is obtainable. That it occurred from some unknown cause in Building No. 14 seems the most probable from all the information that can be obtained. This building was unsprinklered, probably poorly watched and a very slight fire could have gotten a considerable start before breaking out so as to be noticed.

The possibility of the fire starting in the basement of Building No. 10 with a modern sprinkler system, superior construction and no obstruc-

tion to sprinklers combined with its occupancy is almost inconceivable, and it would be hard to believe that a sprinkler failure could occur under the circumstances, assuming the sprinkler protection in operating condition and all valves open. It will also be noted that the basement and first floors were only burned on the east end for about thirty feet and if this fire had started in this section there is no reason to believe but what it would have swept down the entire length of the basement instead of taking a circular course around the stair tower and through the windows into Building No. 14. It is positively stated by the master mechanic that this portion was burned after the sprinkler system was put out of service.

Fig. 6

The cause of this destructive fire is, apparently that the fire originated in Building No. 14, worked its way along the roof to the monitor lantern and was blown by the wind or draught between the building against the windows on the second, third and fourth floors of No. 10, communicating to these floors which were apparently without sufficient supply of water to withstand and check the fire, which is explained in the following lines.

Cause of Failure of Fire Protection.

As far as examination of all the valves from the gravity tank was concerned there was nothing to show but what these were open at the beginning of the fire, the master mechanic stating that he examined the post indicator valve controlling Building No. 10 shortly after arriving on the scene, finding it apparently open, and he says positively the gravity tank was inspected on the Friday before and found full. That there was some water in the tank seems evident by the testimony of several persons who saw the sprinklers operating on the lower floors. There is evidence

Fig. 8

to show on the ceilings of the basement and first floor of Building No. 10 that water had issued from the heads and the spread of the fire checked on these floors.

To offset these statements it would be very possible for a loss like this to occur with a closed or even partly closed valve which might have been opened in the later stages of the fire, also it should be noted that the action of the fire pump which evidently got in service some twenty minutes after the discovery of the fire, and should have given high pressure to the sprinklers, did not show in the least any effect on the flames.

The possibility of obstructions in the sprinkler pipes was investigated. The riser in Building No. 10 was taken down and broken open down to the first floor, feeders and branch lines examined, but nothing was found of note except a small amount of oakum which had no material effect.

There is another feature which may have made a decidedly bad condition for a fire of this character and that is, the heavy draught on the tank occasioned by the number of sprinklers opening. There is about 600 feet of 8-inch (allowing for fittings) and 100 feet of 6-inch pipe extending from the gravity tank to the base of the sprinkler riser in Building No. 10. Referring to Fig. 9, the total number of heads opened outside of the totally burned areas was 153 and it is very probable that at least 75 opened shortly after the fire was discovered which would call for about 1,500 gallon flow. With this flow the loss in pressure in clean cast iron pipe would be about 22 pounds. Since the static pressure from the tank, assuming same to be full, is about 43 pounds at yard level there would be 21 pounds at the base of riser or about enough pressure to carry the water to the fourth floor. It would seem from this that the sprinklers on the

third and fourth floors received little or no water and as more sprinklers opened this pressure was reduced accordingly and probably emptied the tank in less than thirty minutes. As is stated before, it was at least twenty minutes before the fire pump got in action and if three hose streams were used the sprinklers would not get much help from the fire pump.

Conclusion.

1. The most important lesson to be learned from the fire is the undesirable feature of unsprinklered buildings adjoining or exposing sprinklered buildings. It is very necessary before a building is ready for occupancy to provide protection, as sprinklers in adjoining buildings cannot be expected to prevent the fire overtaxing the system and allowing a spread which would be destructive as is shown in the present case.

2. Proper organization and understanding should be had among the night employees regarding all fire protection about the plant. They should be drilled and tested occasionally and be required to see that proper steam pressure is always on hand and the fire pump ready for instant use. Had the fire pump been started and run at its full capacity when the fire was first discovered it is very probable that it could have been checked and kept from spreading into Building No. 10.

3. Where there are two or more watchmen in a group of buildings, like the west group, the rounds should be made hourly using an approved clock and so arranged that they are interlocking. Dials should also be changed daily so as to prevent the doubling of records on two successive nights. It is not clear on the dial removed from the clock which was located in Building No. 10 whether the watchman actually made any rounds on the night of the fire.

4. The use of alarm valves on sprinkler risers is very desirable as it acts in place of discovery by the watchman whose time in a building is actually a small part of the night and on the first signal the night engineer or fireman will be warned of impending trouble.

5. A reliable emergency system of lighting, especially the boiler house and pump rooms, is very necessary. A liberal supply of lanterns kept in readiness for just such an occasion as this fire, would have prevented delay in starting the pump.

6. Weak hydrant protection with locations in obscure and dangerous places is shown to be of but little use such as the one between Buildings No. 6 and 10 which was struck by the falling wall. The scarcity of yard hydrants can be seen by referring to Fig. 9. Ample hydrants and fully equipped hose houses are a necessary feature.

7. A well organized and drilled mill fire brigade is very necessary for a plant of this kind, including watchmen and night employees. A rigid inspection service of all fire protection equipment should also be provided. This should include the inspection of all valves, tanks, fire pump, fire doors, hydrants and hose houses and also minor equipment.

8. Deficient primary supply occasioned by a plant outgrowing its fire protection and also the lack of sufficient elevation. Tanks supplying

both hydrants and sprinkler system should be of large capacity and at a height sufficient to get powerful hose streams and a pressure of 25 pounds on top lines of sprinklers at the start.

9. The value of rolling steel doors is questionable at important fire cut offs and when there are severe conditions. Note conditions of these doors as shown in Figs. 2 and 3.

10. Wired glass windows in metal sash, in the west wall of Building No. 10 proved to be a very effective protection. Some of the glass was melted out and considerable number of panes were cracked but as a whole it was intact. See Figs. 6 and 8.

Fire Causes.

The fires here given are selected to illustrate defects, either of construction or superintendence, in the classes of property indicated.

Gasoline or Other Volatiles.

H-10718. Storage Battery Works. Three gas heated stills located near center of building were in operation using ordinary illuminating gas. For some reason an explosion occurred in the burners of one still and a sheet of flame was blown to the west side of building where there were several wooden tanks containing naphthalene and water. The flame from burner ignited the fumes of naphtha and a heavy explosion resulted. This was not followed by fire.

In the process of the manufacture of carbolic acid, naphthalene is agitated with water in large wooden tanks and there is normally a considerable body of gas in the air over these tanks. The cause of the back fire in the gas burner could not be ascertained.

Although the men at work were somewhat bruised by the force of the explosion, they were not seriously injured.

S-18415. Machine and Forge Shop. In one section of the main machine shop three brick, city gas heated furnaces and two oil quenching tanks five by two by two-and-one-half feet had been installed. Three-inch projectile shells were heated to 1500 degrees Fahrenheit and then dipped in the quenching oil. After this the shells were heated to 1100 degrees Fahrenheit in another furnace and then placed on the cement floor to cool. The quenching oil was a mineral oil having a flash point of 350 degrees Fahrenheit. The main supply of oil came from a wood, metal lined tank of about thirty barrels capacity located on the roof and elevated about twelve feet above the quenching tanks. From the quenching tanks the oil was pumped by an electrically driven pump over a series of metal plates in a frame slatted enclosure over the supply tanks for the purpose of cooling. A poppet valve, which operated by a cord from the ground level was located at the supply tank on a two-inch pipe from it to the quenching tanks. The quenching tanks were without overflow pipes. Outside current was used for driving pump and for lighting the plant. The projectile department was in operation day and night, working in three shifts. When the furnaces for heating the shells were installed a wired glass skylight with metal clad ventilator was constructed over these

furnaces to carry off the excessive heat. An employee on his own responsibility had removed the twelve ordinary degree sprinkler heads from the ceiling in the vicinity of the furnaces and plugged the outlets. The necessary high test heads had not been obtained and the outlets were left plugged without the knowledge of the management of the plant. About 1.15 A. M. the outside current was cut off for a few minutes due to trouble in the power plant. When this happened the plant was thrown into darkness and the motor driving the pump which draws oil from the quenching tanks stopped. On account of the darkness the employees were unable to promptly close the valves in the oil supply line to quenching tanks. The gravity supply from the elevated tanks continued to flow and the quenching tanks overflowed. The oil came in contact with the hot shells on floor and ignited. An employee finally succeeded in closing the valve in the supply line after some four barrels of oil had escaped. The fire quickly spread to the roof and adjoining portions of this fire section but was prevented from entering other sections by the action of automatic sprinklers. Fire was extinguished by the public fire department after the roof and machinery had been badly damaged.

This oil system should have been arranged in a manner to prevent a possible overflow of oil, and the quenching tanks should have had overflow pipes leading to the outside of the building.

H-11362-A. A tank car containing 6,000 gallons of high gravity unblended liquified petroleum gas was received by a carrier of connecting line, with the safety valve popping. Four hours later one of the employees of the receiving line moved the dome cap to relieve the excessive pressure in the tank, for the safety valve was still popping off. The removal of the dome cap permitted the gas to escape in a spray which reached a lighted lantern seventy-five feet away behind a scale box. The liquified gas and the vapors were ignited by the flame of the lantern and the resulting explosion badly burned a car inspector about the hands and face and badly scorched three box cars and the shingles of a section house 100 feet away. The fires surrounding the tank car were extinguished and the fire in the car subsided within fifteen minutes. There was a loss of $1,150.

After the fire was extinguished the safety valve was tested and showed a pressure of twenty-eight pounds per square inch before popping. The Interstate Commerce Commission regulations provide that the dome cover shall not be unscrewed until the absence of vapor pressure in the tank is verified by lifting the safety valve.

H-10769. Employee was opening a drum of gasoline to fill his automobile. This drum had been filled during cold weather and had been in the warm garage for several days before it was opened. When the cap was taken off, the gasoline was shot up to the ceiling due to the pressure. The fumes were ignited by the heat from a stove which was in the rear, several feet away. The public fire department extinguished the fire after considerable damage had been done since the entire room was saturated with liquid.

H-11282. Dry Cleaning Establishment. This was a one-story, ordinary joisted brick building with metal lath and plastered ceilings throughout. The partitions around dry cleaning room, dry rooms and boiler rooms were twelve-inch brick, and all openings to these rooms were protected with single, non-automatic, tin clad fire doors.

The fire occurred in the dyeing room which was also used for drying wet process clothing. On investigation it was found that the plant was in operation and repairs were being made on the steam radiators, all steam being shut off from the boiler. The steam for the gasoline still was taken from the same pipe which supplied the radiators, and an ordinary gate valve was located in steam pipe near entrance to still. The man in charge of the dry cleaning room where still was located was not notified that the steam was to be shut off, therefore he did not close the gate at the still and thus allowed the gasoline in the still to return by gravity into the pipes for some distance. After the repairs on the radiators were completed the steam was again turned on from the boiler. Thus acting as an injector, the steam forced the gasoline from the still through the radiators and from there back through an exhaust line which terminated in a wooden barrel in the dyeing department. The dyeing department adjoined boiler room, and doors to both rooms were open. Either the gasoline vapor ignited from the fire under the boiler or someone was carelessly smoking in the dyeing room.

All steam lines to gasoline stills should be direct, with no connections whatever to other heating apparatus.

S-18378. Hotel Kitchen. Fire started on a bench in kitchen used for singeing and dressing chickens. The singeing was done by heat from burning wood alcohol. The receptacle containing the liquid became upset. One sprinkler directly over the bench (under duct vent) extinguished the blaze.

H-11240. Gas Works. This fire occurred at a still for the recovery of oils from tar (heavy naphtha). The tank receptacles, about six by six feet, were open at the top. None of the employees was in the immediate vicinity when the flash of fire took place by the ignition of the oil in the tanks. It is supposed that the heavy vapor was driven by the wind down and into the fire in the furnace at the front of the building. The burning oil was allowed to burn itself out, while water was kept on the iron columns, thus preventing them from buckling.

H-11221. Garage. Employees were working underneath a motor truck, using an extension electric light. The wire became broken and when the light was suddenly moved a spark ignited the gasoline vapor and gasoline in tank of truck. Fire was extinguished by a line of hose from the fire department's chemical engine.

H-11253. Apartment House. A woman, cleaning a dress in the kitchen with an open vessel containing gasoline, was near the kitchen furnace and only two feet from a lighted gas iron. A flash fire occurred which resulted in serious burns to the woman and a child who was in the

room. The woman stated the only precaution she thought necessary was to lower the window in order to allow the fumes to escape.

Motion Picture Films.

H-11362-B. A steel baggage car lighted by electricity and heated by steam and a stove, containing baggage, company material and express matter, including among the latter a shipment of moving picture films, was discovered on fire after leaving the station about 8.30 P. M. The train was run to the next station where the car was cut out and railroad employees used a stretch of hose until the city department arrived and extinguished the fire. The car was badly damaged and the contents practically destroyed. The loss in all amounted to several thousand dollars. When the car started on its trip there was a fire in the stove which was not replenished as the night was a warm one. The films were placed on top of a crate of live animals on the opposite side of the car from the stove with but a small express package separating the films from the steam coils. There was evidently considerable heat in the car on account of it being closed, and from an investigation made by the railroad the indications are that the fire was caused by the ignition of the films probably on account of their being placed too near the heated steam coils. An examination of the remains of the films showed that they were enclosed in a circular tin container and according to the statement of the express manager they were packed in an outside wooden box.

H-10792. Motion Picture Theatre. This fire resulted from unknown cause by a film igniting while the machine was being operated. The flame was cut off at the slot in the upper magazine but the heat effect extended into the magazine and as the fumes appeared to be coming from container the operator seized a hand extinguisher just as the door of the container blew open from the gases. The stream from the extinguisher was directed on the reel of film and quickly extinguished the blaze. Some of the audience in the upper gallery seeing the confusion in the booth started to leave, but as the fumes were carried out by the ventilating pipe the audience below was unconscious of any trouble.

Chemicals.

H-10778. Electro-Chemical Company. This fire was caused by the result of an explosion that occurred in the concrete cooling pit directly below the electro-phosphoric furnace in the acid plant building. The cause of the explosion is stated briefly as follows: The acid plant prior to the explosion was in full experimental operation, running both day and night. Just before the explosion, which occurred about 2.50 A. M. the electric furnace was in full operation, containing a charge of the usual quantity of phosphate rock, coke and sand, and was heated to a temperature of approximately 1,700 degrees C. While containing this charge and under heat, one of the nozzle plugs that permitted molten slag to discharge from furnace to cooling pit below blew out, and immediately the molten

contents of furnace discharged into cooling pit. Some water was in this cooling pit and the sudden and rapid generation of steam caused by this molten slag falling in water caused an explosion that scattered slag at high velocity throughout this end of the building. Some of the slag was blown through joisted roof and walls of building and against both extra high, high and low tension electric wires in the vicinity, breaking down and damaging the wires considerably. The resulting fire was caused by the slag that exploded being forced against 2,300-volt, three-phase wires and exposed single pole knife switches in nearby transformer room, between the entrance point of these wires to building and the automatic circuit breaker protecting these wires. A short circuit immediately occurred which heated the wires to incandescence and ignited the woodwork of roof and walls.

When the explosion occurred all the employees in this building immediately left. The fire ensuing immediately followed the explosion, therefore rendering useless the chemical extinguishers that were near the electric furnace. However, as soon as employees observed the fire they immediately set to work laying hose lines from the two private hydrants of the plant and very soon the fire was entirely extinguished, but in doing so a considerable quantity of water got into the electric transformers, oil switches, motor starters and other apparatus on switchboard.

H-11244. Chemical Works Manufacturing Picric Acid. The one-story open joist building in which the fire occurred was used for picric acid recovering where the crude freshly nitrated picric acid was dissolved and treated to the proper moisture in centrifuges. The sulphonation of phenol (carbolic acid) also took place here. This building was on a hillside sloping toward the west, with several floor levels, the floors being concrete except the false wooden floors around the vats. Some thirty or more vats were located in the middle section on the second level from the bottom. The lower level contained at the east side two phenol sulphonating tanks (round lead lined tubs with agitators) and a long lead lined trough-like tank into which the sulphonated phenol passed from mixers before being taken from nitrating building where the final reaction was carried out, which resulted in picric acid. Near here there was a steam engine which furnished power to operate the centrifuges in which the mother liquor was thrown off from the recrystallized picric acid and the good crystals, containing twenty per cent moisture, were put in barrels and taken to the storehouse. The remainder of the lower level contained old wooden vats and wooden coat lockers for employees. In the easterly portion of the building, just east of the crystallizing vats, was deposited the crude picric acid fresh from the nitrating building. It is of interest to note that this acid only contained five per cent of moisture. It was in open barrels and boxes. The rest of this end of the building was unoccupied.

The plant was operating on a twenty-four hour schedule and the fire was discovered by one of the employees entering the building a few minutes after 6 P. M. The public fire department was called and used three hose streams upon this building. The roof of the building collapsed and a

good portion of it was destroyed. The lead lined sulphonating vats were charred and burned and the lead melted down to the level of the liquor. At this point it was very evident that the liquor retarded the further progress of the fire. The remainder of the vats were intact and the liquor remained therein. The large crystallizing tubs containing the dissolved picric acid were in no instance destroyed. In several places the yellow salt (picric acid) was evident on the outside of the vats where it had leaked through and the liquor evaporated, leaving an unburned yellow stain amid the charred surroundings. On the upper levels where the crude acid was located several boxes and tubs containing this salt, with only five per cent of moisture, were partially consumed, the charred remains being visible and in some cases a considerable quantity of unconsumed acid also remained.

There are examples to show the action of phenol (carbolic acid) in this fire. One iron drum and several milk cans containing phenol were in the building. This material will burn with a heavy smoke but apparently not with great vigor, for several cans were upset with the phenol which had liquified under heat, resolidified on the side, considerable still remaining in the cans. It was reported that there was not the least sign of an explosion and that the fire was not particularly vigorous.

Electrical.

H-10788. Opera House. Fire was discovered about 11.30 P. M. while the opera house was filled with people. It appears that a plush curtain used to drape one of the boxes on the fourth floor gallery obstructed the view and was carelessly thrown over a sixteen candle power incandescent lamp affixed to side wall, high enough to be out of ordinary injury. The heat from the lamp became sufficient to ignite the fabric. The prompt discovery of fire by the watchman making his rounds prevented any trouble.

H-10775. A small fan motor operated on a 220-volt D. C. circuit. Someone had placed **125-volt** Edison plug fuses in this circuit. The metal cabinet door where these fuses were had been left open by an electrician who was repairing fan motor so that when a short circuit occurred on the motor line the resulting sparks from molten metal from these low voltage fuses dropped into a barrel of cedarine sweeping compound and ignited it. Fire was quickly extinguished with two and one-half gallon chemical extinguishers.

The ordinary Edison plug fuse is designed for 125-volts and should never be used for 220-volts.

H-11272. Piano Store. Concealed electric wiring damaged by a recent fire was connected with current without a permit and resulted in a short circuit between the floor and ceiling. The damage was slight owing to early discovery of the fire.

H-11267. Hospital. Lightning apparently entered the building on the lighting company's service wires, grounded at combination bracket

and burned a hole in gas pipe, igniting the gas and causing a fire in hollow partition on the second floor in one of the operating rooms. The prompt discovery confined the loss to about $20.00. The canopy insulator at the bracket fixture had been broken so that this fixture was not insulated and was in contact with the outlet box of the grounded conduit system. The fixture wire insulation broke down and the arc burned a hole about two inches long in the one-eighth-inch gas fixture arm. **The electrical equipment in this building had been reported by the electrical inspection department as being in an extra hazardous condition, but despite the nature of the occupancy no steps had been taken to improve matters.**

Miscellaneous.

S-13632. Employees were coating with tar a wooden washing tray used in the photographic department when in some unaccountable manner the tar became ignited. The fire itself was not very serious but the smoke from the burning tar blackened the ceiling and walls.

S-18449. Smoke House in Packing Plant. This smoke house was constructed with two sides of hollow tile and the other two sides utilizing the brick walls of main building. A fire of oak logs was built in the basement and smothered with wet hardwood sawdust to make a smoke. The whole house was filled with meat hanging on hooks for smoking. The meat in the house at this particular time was unusually fatty and it is supposed that some of the fat melted due to the heat and dripped onto the fire, which caused it to flare up and ignite the meat. The prompt discovery of fire and the superior construction of the smoke house confined the loss to the meat which was valued at $4,500.

S-18459. Steel Foundry. Approximately 33,000 pounds of molten steel had been run from furnace into a ladle. While the latter was being moved it broke and the molten metal ran on the floor. In attempting to move the metal from the floor by means of a traveling crane, a one-half-inch oil pipe was broken above the inside shut-off valve. The oil under thirty pounds air pressure came in contact with the hot metal, causing a sheet of flame which reached to the roof. It is claimed, and practically borne out by the number of sprinklers which opened, that the flame was blown over a considerable area on the ceiling due to draft from the open doors at both ends of the building, which was of large area. Fire was confined to the roof planks and was practically extinguished by the sprinklers, although two lines of hose were used for a short time.

S-18343. Cordage Works. This firm did not [illegible] a great deal of storage space and so when heavy shipments of jute arriv[illegible] rapid succession during the latter part of August and September it [illegible] as decided to place some of this material upon the roof of a two-story reinforced concrete building. The stock was well covered with tarpaulins which were held in place by weights. It occupied an area approximately eighty by thirty feet.

Fire occurred during a severe thunder shower and the origin was generally ascribed to lightning, as several people stated that the fire was

observed directly after a heavy flash of lightning. However, the building showed no effects of being struck. This shower occurred at the end of a period of several days of hot weather. The stock would have had every chance to become heated under the tarpualins and it is possible that if any of the jute had become wet, spontaneous ignition might have taken place rapidly. The fire was fought with hose streams supplied by the public fire department and the 1000-gallon fire pump. The seat of the fire was in the midst of the bales and it was very difficult to reach it with water so that it burned for several days. The loss was largely due to water although there was a considerable amount of the jute burned. Some water also ran down through skylights of building and down the brick elevator shaft at southeast corner of the building so that a small water loss resulted to machinery and stock on second floor. As nearly as could be learned every bale on the roof swelled and burst the bands holding it together, and this stock in swelling pushed off the cement coping of roof along the south side for a distance of about seventy feet. The loss was settled on the basis of 1200 bales being totally destroyed and was approximately $30,000.

S-18458-A. Motion Picture Studio. The room in which this fire occurred was used for the treating of wooden developing frames with paraffine. The paraffine was melted in a galvanized sheet iron pot heated by the direct flame of eight one-burner stoves. These stoves had flexible tube connections with rubber joints. Stoves were set up on empty paint cans, all being portable. When the paraffine was melted the developing frames were immersed in it and allowed to remain there for a period of fifteen minutes. Two employees were doing this work at the time of the fire. One employee upset the paraffine pot, spilling the boiling material on top of the stoves and floor. The paraffine ignited causing considerable heat in a short time, which was added to by the eight open gas flames in the stove connections after the rubber joints had burned off. Eight sprinklers operated for about ten minutes and entirely extinguished the fire.

Annual Summary.

Statistics of Fires in Properties Having Automatic Sprinkler Protection.

NOTE. — These tabulations are made at the close of each fiscal year, with the object of furnishing a basis upon which the virtue of the automatic sprinkler as an extinguishing agent can be estimated.

Section I is devoted to fires in which the behavior of sprinklers was, for the reasons given, unsatisfactory.

Section II is a statistical record of all reports of sprinkler fires in the files of the Association upon which the information obtained is sufficiently complete for statistical purposes.

In each table the results of the current year ending April 1, 1916, are given, and these are compared to the results of the total nineteen-year record ending at that time.

There have been 1340 fires reported during the year in which automatic sprinklers operated. This number is somewhat smaller than that reported last year and would seem to indicate that the Association has not received as complete co-operation from those having information as has been the case in the past. It is hoped that the Association may continue to receive reports on a large percentage of the fires in sprinklered properties, for it is impossible to arrive at accurate conclusions unless the record for each classification embraces a considerable number of fires.

A study of these statistics does not bring out any important changes from those given in the past. The unsatisfactory fires remain approximately the same, 3.81 percent for the last year and 4.65 percent for the complete record. The ability of the sprinklers to practically or entirely extinguish fire shows an increase over the last few years as evidenced by the fact that 73.43 percent were extinguished in this year's record as compared with 64.51 percent for the total record.

The detailed information upon the results obtained in different classes of property as given under Table 9 brings out many interesting points and shows that even among those types of occupancy with comparatively poor record, the automatic sprinkler still gives a result which completely justifies its installation.

The number of heads opening as given in Table 5 continues to emphasize the fact that approximately one-third of the fires result in the operation of only one head, while over four-fifths of all fires do not open more than ten heads.

The data on efficiency of alarm systems gives us some very interesting information as to the relative value of watchmen, sprinkler alarms and other devices. The continued good showing of the sprinkler alarm as a device for discovering fire should be especially noticed, since in only 3.5 per cent of those instances where the sprinkler alarm was the only device did it fail to operate and report the fire.

Special Classification of Fires in which Failure was Due to Water Being Shut Off Sprinklers

	1915-1916. No. of Fires.	1897-1916 Inc. No. of Fires.
Water shut off for unknown reason, neglect or carelessness	10	88
Water shut off before fire was out or fire rekindled	2	32
Water shut off due to accidents or repairs	3	34
Water shut off to prevent freezing	3	36
Water shut off, probably incendiary	..	10
Water shut off, leaky dry system	..	3
Water shut off, miscellaneous	1	7
Water shut off, defective gate valve	..	2
Total	19	212

SECTION I.

Summary of Unsatisfactory Sprinkler Fires.

	1915-1916. No. of Fires.	1915-1916. Per Cent.	1897-1916. No. of Fires.	1897-1916. Per Cent.
Water shut off sprinklers	19	37.3	212	26.1
Generally defective equipment	1	2.0		
Unsprinklered portions	10	19.5	190	23.4
Defective heads	1	2.0		
Defective water supply or supplies	4	7.8	81	10.0
Sprinkler system crippled due to freezing	..	..	18	2.2
Slow operation of dry system or defective valve	..	..	18	2.2
Slow or defective operation of high test heads	1	2.0	14	1.7
Faulty building construction, concealed spaces, vertical openings, etc.	3	5.9	39	4.8
Obstruction to distribution	6	11.7	49	6.0
Hazard of occupancy too severe for average sprinkler equipment	..	..	37	4.6
Explosion crippled sprinkler system	4	7.8	35	4.3
Exposure or conflagration	..	..	62	7.6
Miscellaneous	1	2.0	30	3.7
Plugged heads	1	2.0		
Not classified	..	..	28	3.4
Total	51		813	

SECTION II.

Annual Revision of Sprinkler Fire Tables.

In the following ten tables is given a summary of fires occurring in properties equipped with automatic sprinklers. The total number of such fires reported during the year was 1609, which includes 269 fires where no sprinklers were opened. Several reports were also received in which the data was incomplete, and these were not used in this summary.

Table No. 1.

Time of Day.

	No. of Fires. 1915-1916.	No. of Fires 1897-1916 Inc	Per cent of No. with Data Given. 1915-1916.	1897-1916 Inc.
6 a. m. to 6 p. m.	684	8943	51.3	58.2
6 p. m. to 6 a. m.	649	6449	48.7	41.8
Total with data given	1333	15392		
No data	7	317		
Total	1340	15709		

Table No. 2.

How Discovered.

	No. of Fires. 1915-1916.	No. of Fires. 1897-1916 Inc	Per cent of No. with Data Given. 1915-1916.	1897-1916 Inc.
Employee	699	9129	52.7	59.8
Watchman	209	2381	15.7	15.6
Sprinkler Alarm	289	2265	21.7	14.9
Outsider	65	801	4.9	5.2
Thermostats	46	555	3.5	3.6
Automatic Pump	..	10	..	.06
Supervisory System	21	134	1.5	.84
Total with data given	1329	15275		
No data	11	434		
Total	1340	15709		

Table No. 3.

Efficiency of Alarm Service, 1915-1916.

	Satisfactory. No. of Fires.	Satisfactory. Per Cent.	Failure. No. of Fires.	Failure. Per Cent.	Total.
Watchman alone	128	87.1	19	12.9	147
Sprinkler alarm alone	164	96.5	6	3.5	170
Thermostats alone	13	81.2	3	18.8	16
Supervisory system alone	10	100.0	..	..	10

	Watchman.		Sprinkler Alarm.		Thermostat.		Supervisory.		Total.
	Satisfactory.	Failure.	Satisfactory.	Failure.	Satisfactory.	Failure.	Satisfactory.	Failure.	
Watchman and Sprinkler Alarm	77	81*	139	19	..	..	..	..	158
Watchman and Thermostats	6	1*	..	..	6	1	..	..	7
Sprinkler Alarm and Thermostats	..	..	31	5	27	9	..	..	36
Watchman, Sprinkler Alarm and Thermostats	1	2*	3	..	3	..	..	..	3
Sprinkler Alarm and Supervisory	..	..	31	3	..	..	34	..	34
Watchman and Supervisory	2	..	..	..	..	..	2	..	2
Watchman, Sprinkler Alarm and Supervisory	8	9*	16	1	..	..	17	..	17
Sprinkler Alarm, Thermostats and Supervisory	..	..	5	1	5	1	6	..	6

Efficiency of Alarm Service, 1897-1916, Inclusive.

	Satisfactory.		Failure.		Total.
	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.	
Watchman alone	1383	89.5	162	10.5	1545
Sprinkler alarm alone	1460	93.6	100	6.4	1560
Thermostats alone	170	78.7	46	21.3	216

	Watchman.		Sprinkler Alarm.		Thermostat.		Supervisory.		Total.
	Satisfactory.	Failure.	Satisfactory.	Failure.	Satisfactory.	Failure.	Satisfactory.	Failure.	
Watchman and Sprinkler Alarm	1008	631*	1439	200	..	..	..	..	1639
Watchman and Thermostats	19	6*	..	..	23	2	..	..	25
Sprinkler Alarm and Thermostats	..	..	439	35	361	113	..	..	474
Watchman, Sprinkler Alarm and Thermostats	35	55*	83	7	70	20	..	..	90
Watchman and Supervisory	4	4*	..	..	..	..	8	..	8
Sprinkler Alarm and Supervisory	..	..	147	7	..	..	150	4	154
Watchman, Sprinkler Alarm and Supervisory	47	54*	100	1	..	..	100	1	101
Sprinkler Alarm, Thermostats and Supervisory	..	..	26	1	22	5	27	..	27

*These include fires where sprinkler alarm or thermostats notified the watchman.

Note. — These tables do not include fires where alarm sevice does or does not operate promptly if fire is at once discovered by employee, the alarm service having no bearing on such fires one way or the other.

Table No. 4.

Number of Sprinklers Operating.

No. of Sprinklers Operating.	No. of Fires. 1915-1916.	No. of Fires. 1897-1916, Inc.	Per Cent of Whole. 1915-1916.	Per Cent of Whole. 1897-1916, Inc.
1	450	5314	34.6	31.1
2	226	2797	17.4	16.4
3	149	1761	11.5	10.3
4	86	1262	6.6	7.4
5	57	815	4.4	4.8
6	49	695	3.8	4.1
7	26	445	2.0	2.6
8	30	440	2.3	2.6
9	20	294	1.5	1.7
10	9	260	.7	1.5
11	12	226	.9	1.3
12	16	245	1.2	1.4
13	7	140	.5	.8
14	15	170	1.2	1.0
15	8	132	.6	.8
16 to 20	29	460	2.3	2.7
21 to 25	28	306	2.2	1.8
26 to 30	12	210	.9	1.2
31 to 35	15	133	1.2	.8
36 to 40	8	104	.6	.6
41 to 50	12	155	.9	.9
51 to 75	17	212	1.3	1.2
76 to 100	10	104	.8	.6
Over 100	8	413	.6	2.4
Total with data given	1299	17093		
Water shut off sprinklers	19	178		
No data	22	262		
Total	1340	17533		

Table No. 5.

Number of Sprinklers Operating.

No. of Sprinklers Operating	No. of Fires. 1897-1916, Inc.	Per Cent of Whole. 1897-1916, Inc.
1	5314	31.1
2 or less	8111	47.5
3 or less	9872	57.8
4 or less	11134	65.2
5 or less	11949	70.0
6 or less	12644	74.1
7 or less	13089	76.7
8 or less	13529	79.3
9 or less	13823	81.0
10 or less	14083	82.5
11 or less	14309	83.8
12 or less	14554	85.2
13 or less	14694	86.0

Table No. 5—Continued.
Number of Sprinklers Operating.

No. of Sprinklers Operating	No. of Fires. 1897-1916 Inc.	Per Cent. of Whole 1897-1916 Inc.
14 or less	14864	87.0
15 or less	14996	87.8
20 or less	15456	90.5
25 or less	15762	92.3
30 or less	15972	93.5
35 or less	16105	94.3
40 or less	16209	94.9
50 or less	16364	95.8
75 or less	16576	97.0
100 or less	16680	97.6
Over 100	413	2.4
Total with data given	17093	
Water shut off sprinklers	178	
No data	262	
Total	17533	

Table No. 6.
Sprinklers Opened on Wet or Dry Systems.

	No. of Fires. 1915-1916.	No. of Fires. 1897-1916, Inc.	Per Cent of No. with Data Given. 1915-1916.	1897-1916, Inc.
Wet system	1046	12236	79.3	80.2
Dry system	272	3016	20.7	19.8
Total with data given	1318	15252		
Water shut off system	19	178		
No data	3	279		
Total	1340	15709		

Table No. 7.
Primary Water Supplies to Sprinklers Opened.

	No. of Fires. 1915-1916.	No. of Fires 1897-1916, Inc.	Per Cent. of No. with data given. 1915-1916.	1897-1916, Inc.
Waterworks	707	7809	53.8	51.5
Gravity Tank	270	4196	20.5	27.5
Pressure Tank	252	2353	19.2	15.4
Automatic Steam Pump	85	867	6.5	5.55
Automatic Electric Pump	0	4	..	.029
Steamer Connection	0	3	..	.021
Total with data given	1314	15232		
Water shut off system	19	178		
No data	7	309		
Total	1340	15719		

Table No. 8.

Effect of Sprinklers.

	No. of Fires. 1915-1916.	No. of Fires 1897-1916, Inc.	Per Cent. of No. with Data Given. 1915-1916.	1897-1916, Inc.
Practically or entirely extinguished fire	984	11310	73.43	64.51
Held fire in check	305	5410	22.76	30.84
Total successful	1289	16720	96.19	95.35
Unsatisfactory	51	813	3.81	4.65
Total	1340	17533		

Table No. 9.

Showing Effect of Sprinklers by Class of Occupancy.

	Extinguished Fire.		Held Fire in Check		Total Satisfactory.		Unsatisfactory.		Total No. of Fires
	No.	%	No.	%	No.	%	No.	%	
Agricultural Implements	42	59.2	26	36.6	68	95.8	3	4.2	71
Automobile and Bicycle Factories	53	59.5	31	34.9	84	94.4	5	5.6	89
Awning Factories	5	100.0	...	....	5	100.0	..	....	5
Bag Factories	4	57.2	3	42.8	7	100.0	..	....	7
Bakeries	27	67.5	11	27.5	38	95.0	2	5.0	40
Basket Factories	7	100.0	...	....	7	100.0	..	....	7
Bolt, Nut and Screw Works	11	73.3	4	26.7	15	100.0	..	....	15
Boot and Shoe Shops	371	74.7	107	21.5	478	96.2	19	3.8	497
Bottling Works	4	100.0	...	....	4	100.0	..	....	4
Braiding Mills	4	80.0	1	20.0	5	100.0	..	....	5
Breweries	5	83.4	1	16.6	6	100.0	..	....	6
Broom Factories	8	61.5	3	23.1	11	84.6	2	15.4	13
Brush Factories	8	80.0	2	20.0	10	100.0	..	....	10
Button Manufactories	15	88.3	2	11.7	17	100.0	..	....	17
Candle Factories	4	66.7	2	33.3	6	100.0	..	....	6
Candy Factories	49	74.3	16	24.3	65	98.6	1	1.4	66
Canning Works	7	70.0	2	20.0	9	90.0	1	10.0	10
Car Houses	19	47.5	16	40.0	35	87.5	5	12.5	40
Car Works	52	65.8	25	31.7	77	97.5	2	2.5	79
Carpet Mills	102	57.7	66	37.3	168	95.0	9	5.0	177
Carriage Factories	81	66.4	34	27.9	115	94.3	7	5.7	122
Celluloid (Pyroxylin Plastic)	77	66.3	23	19.8	100	86.1	16	13.9	116
Cement and Plaster Works	2	66.7	...	....	2	66.7	1	33.3	3
Cereal Mills	25	67.6	8	21.6	33	89.2	4	10.8	37
Chemical and White Lead	32	56.1	21	36.9	53	93.0	4	7.0	57
Clothing Factories	344	78.8	85	19.5	429	98.3	7	1.7	436
Coffee and Spice Mills	34	72.3	13	27.7	47	100.0	..	....	47
Coffin Factories	32	80.0	7	17.5	39	97.5	1	2.5	40
Cold Storage Plants	3	50.0	3	50.0	6	100.0	..	....	6
Cooperage Plants	41	55.4	25	33.8	66	89.2	8	10.8	74
Cordage Works	173	66.3	79	30.3	252	96.6	9	3.4	261
Cork Factories	6	50.0	4	33.3	10	83.3	2	16.7	12
Corset Factories	4	57.2	2	28.6	6	85.8	1	14.2	7
Cotton Ginnery	10	66.7	5	33.3	15	100.0	..	....	15
Cotton Mills	2808	60.7	1763	38.2	4571	98.9	52	1.1	4623
Cotton Warehouses	86	43.2	92	46.2	178	89.4	21	10.6	199
Cotton Seed Oil Mills	36	53.8	21	31.3	57	85.1	10	14.9	67
Cutlery and Hardware	7	53.8	5	38.5	12	92.3	1	7.7	13
Department Stores	256	79.6	55	17.0	311	96.6	11	3.4	322

Table No. 9—Continued.

	Extinguished Fire		Held Fire in Check		Total Satisfactory.		Unsatisfactory		Total No. of Fires
	No.	%	No.	%	No.	%	No.	%	
Distilleries	6	75.0	2	25.0	8	100.0	..	....	8
Drug Houses	100	80.7	20	16.1	120	96.8	4	3.2	124
Dry Cleaning Establishments	4	80.0	1	20.0	5	100.0	..	....	5
Dyeing and Bleaching	79	46.2	82	47.9	161	94.1	10	5.9	171
Electrical Appliances	86	75.5	25	21.9	111	97.4	3	2.6	114
Electric and Light Power Plants	2	40.0	2	40.0	4	80.0	1	20.0	5
Elevators, Grain	19	37.2	17	33.3	36	70.5	15	29.5	51
Excelsior Factories	19	79.2	4	16.7	23	95.9	1	4.1	24
Fertilizer Plants	14	60.8	7	30.4	21	91.2	2	8.8	23
Flax and Linen Mills	15	44.2	19	55.8	34	100.0	..	....	34
Flour and Grist Mills	38	54.3	26	37.2	64	91.5	6	8.5	70
Forge and Smithy	10	76.9	3	23.1	13	100.0	..	....	13
Foundries	90	54.2	68	40.9	158	95.1	8	4.9	166
Furniture Factories	337	65.6	133	25.9	470	91.5	44	8.5	514
Garages	35	63.7	18	32.8	53	96.5	2	3.5	55
Garbage Reduction Plants	3	60.0	1	20.0	4	80.0	1	20.0	5
Gas Plants	2	100.0	...	....	2	100.0	..	....	2
Glass Works	31	63.3	14	28.6	45	91.9	4	8.1	49
Glove Factories	7	87.5	1	12.5	8	100.0	..	....	8
Glue Factories	4	57.2	1	14.2	5	71.4	2	28.6	7
Harness and Fancy Leather	44	81.5	10	18.5	54	100.0	..	....	54
Hat, Fur	31	66.0	11	23.4	42	89.4	5	10.6	47
Hat, Straw	5	41.7	7	58.3	12	100.0	..	....	12
Hatters Fur Manufacturing	5	55.6	4	44.4	9	100.0	..	....	9
Ice Plants	1	100.0	...	....	1	100.0	..	....	1
Incandescent Lamp Factories	9	60.0	6	40.0	15	100.0	..	....	15
Insulated Wire Factories	20	64.5	11	35.5	31	100.0	..	....	31
Jewelry Shops	86	86.8	9	9.1	95	95.9	4	4.1	99
Junk Shops	4	80.0	1	20.0	5	100.0	..	....	5
Knitting Mills, Cop Yarn	34	58.7	19	32.7	53	91.4	5	8.6	58
Knitting Mills, Full Process	362	63.7	184	32.3	546	96.0	23	4.0	569
Laundries	19	55.8	13	38.2	32	94.0	2	6.0	34
Lead Pencil Factories	10	77.0	3	23.0	13	100.0	..	....	13
Linseed Oil Works	11	61.2	6	33.3	17	94.5	1	5.5	18
Machine Shops	169	62.4	87	32.1	256	94.5	15	5.5	271
Match Factories	41	73.2	11	19.6	52	92.8	4	7.2	56
Mattress Factories	172	76.1	50	22.1	222	98.2	4	1.8	226
Mercantile	513	78.9	120	18.5	633	97.4	17	2.6	650
Metal Reduction Works	3	75.0	1	25.0	4	100.0	..	....	4
Metal Workers	416	64.7	197	30.7	613	95.4	30	4.6	643
Miscellaneous	178	69.0	68	26.3	246	95.3	12	4.7	258
Morocco Leather Shops	6	30.0	11	55.0	17	85.0	3	15.0	20
Motion Picture Theatres	10	71.5	4	28.5	14	100.0	..	....	14
Musical Instrument Factories	76	68.5	31	27.9	107	96.4	4	3.6	111
Oil Clothing Factories	7	70.0	3	30.0	10	100.0	..	....	10
Oilcloth and Linoleum Works	20	28.2	35	49.3	55	77.5	16	22.5	71
Oil Refineries	3	42.8	4	57.2	7	100.0	..	....	7
Packing House and Slaughter	43	67.2	19	29.7	62	96.9	2	3.1	64
Paint and Color Works	103	74.1	32	23.0	135	97.1	4	2.9	139
Paper Box and Papeterie	73	73.0	26	26.0	99	99.0	1	1.0	100
Paper Mills	230	51.7	170	38.2	400	89.9	45	10.1	445
Patent Leather Works	5	41.6	5	41.6	10	83.2	2	16.8	12
Picture Frame Factories	30	65.3	12	26.1	42	91.4	4	8.6	46
Plumbers' Supplies	10	76.8	3	23.2	13	100.0	..	....	13
Potteries	34	64.2	17	32.1	51	96.3	2	3.7	53

Table No. 9—Concluded.

	Extinguished Fire		Held Fire in Check		Total Satisfactory.		Unsatisfactory.		Total No. of Fires
	No.	%	No.	%	No.	%	No.	%	
Printing and Lithographing	312	79.6	67	17.1	379	96.7	13	3.3	392
Pulp, Miscellaneous	5	26.3	10	52.6	15	78.9	4	21.1	19
Pulp, Soda	1	20.0	1	20.0	2	40.0	3	60.0	5
Pulp, Sulphite	14	40.0	14	40.0	28	80.0	7	20.0	35
Restaurants	10	100.0	...	....	10	100.0	..	....	10
Rice Mills	...	....	1	100.0	1	100.0	..	....	1
Rolling, Wire and Tube Works	13	46.4	14	50.0	27	96.4	1	3.6	28
Roofing Works	11	44.0	13	52.0	24	96.0	1	4.0	25
Rubber Cloth Factories	8	53.3	7	46.7	15	100.0	..	....	15
Rubber Reclaiming Works	3	33.3	5	55.6	8	88.9	1	11.1	9
Rubber Works	74	50.7	65	44.5	139	95.2	7	4.8	146
Saw and Planing Mills	57	41.3	45	32.6	102	73.9	36	26.1	138
Shirt Factories	29	80.5	7	19.5	36	100.0	..	....	36
Shoddy Mills	121	64.1	54	28.5	175	92.6	14	7.4	189
Silk Mills	28	65.2	12	27.9	40	93.1	3	6.9	43
Skin Mills	2	66.7	1	33.3	3	100.0	..	....	3
Soap Manufacturing	20	80.0	4	16.0	24	96.0	1	4.0	25
Stamping and Sheet Metal Works	26	56.5	15	32.6	41	89.1	5	10.9	46
Starch and Glucose Mills	8	47.1	3	17.7	11	64.8	6	35.2	17
Sticky Fly Paper Factories	3	75.0	1	25.0	4	100.0	..	....	4
Sugar Refineries	13	68.4	6	31.6	19	100.0	..	....	19
Tanneries	25	47.2	23	43.3	48	90.5	5	9.5	53
Tenant Manufacturing	332	71.4	110	23.7	442	95.1	23	4.9	465
Theatres	27	75.0	8	21.2	35	96.2	1	3.8	36
Tobacco Factories	36	66.7	15	27.8	51	94.5	3	5.5	54
Trunk Factories	6	66.7	3	33.3	9	100.0	..	....	9
Varnish Works	4	66.7	1	16.7	5	83.4	1	16.6	6
Wall Paper Factories	9	69.2	1	7.7	10	76.9	3	23.1	13
Warehouses	139	69.2	51	25.3	190	94.5	11	5.5	201
Waste and Batting Mills	165	68.3	69	28.5	234	96.8	8	3.2	242
Waste Paper and Rag Shops	23	69.7	10	30.3	33	100.0	..	....	33
Weaving Mills	75	60.9	44	35.8	119	96.7	4	3.3	123
Whip Factories	3	60.0	2	40.0	5	100.0	..	....	5
Window Shade Factories	7	87.5	...	....	7	87.5	1	12.5	8
Woodworkers, Class A *	96	53.0	61	33.7	157	86.7	24	13.3	181
Woodworkers, Class B *	87	48.3	74	41.1	161	89.4	19	10.6	180
Woodworkers, Class C *	82	59.0	49	35.3	131	94.3	8	5.7	139
Woodworkers, Class D *	63	57.3	33	30.0	96	87.3	14	12.7	110
Woodworkers, Class E *	68	61.8	35	31.8	103	93.6	7	6.4	110
Woodworkers, Class F *	25	64.1	11	28.2	36	92.3	3	7.7	39
Woodworkers, Miscellaneous	1	50.0	1	50.0	2	100.0	..	....	2
Woolen Mills	687	70.4	239	24.5	926	94.9	50	5.1	976
Wool Storehouses	20	71.5	6	21.4	26	92.9	2	7.1	28
Worsted Mills	34	50.0	22	32.3	56	82.3	12	17.7	68
Total Sprinkler Fires	11310		5410		16720		813		17533

*Note.— The Woodworkers are classed as follows:

Class A. Planing Mills; interior woodwork, builders' supplies (including veneer works).

Class B. Box Factories (including cigar boxes).

Class C. Miscellaneous Woodworkers. Steam power tenant woodworkers (also woodworkers where there is a lack of detailed information as to class).

Class D. Sash, Door and Blind Factories.

Class E. Hard Wood Turning (wheels, pipes, novelties, bobbins, spools, etc., last and wood heel factories).

Class F. Pails and Woodenware. (Plates, wooden bowls, tubs, etc.)

Table No. 10.

Classification of Unsatisfactory Sprinkler Fires by Occupancies.

	Water shut off sprinklers.	Gen. defective equipment and unsprinklered portions.	Defective water supply or supplies.	Sprinkler system crippled due to freezing.	Slow operation of dry system or defective dry valve.	Slow or defective operation of high test heads.	Faulty building construction, concealed spaces, vertical openings.	Obstruction to distribution.	Hazard of occupancy too severe for average sprinkler equipment.	Explosion crippled sprinkler system.	Exposure or conflagration.	Miscellaneous.	Not classified.	Total.
Agricultural Implements	2	..	..	..	..	..	..	..	1	..	..	..	..	3
Automobile and Bicycle	1	1	..	..	..	..	..	2	..	..	1	..	..	5
Bakeries	..	1	..	..	..	..	..	..	..	..	..	1	..	2
Boot and Shoe Shops	5	2	2	..	..	1	..	1	..	2	5	..	1	19
Broom Factories	2	..	..	..	..	..	..	..	..	..	..	..	..	2
Candy Factories	..	..	..	..	..	..	1	..	..	..	..	..	..	1
Canning Works	..	..	..	..	..	..	..	..	..	..	1	..	..	1
Car Houses	1	1	1	..	1	..	..	1	..	..	..	..	..	5
Car Works	..	1	..	..	..	..	..	1	..	..	..	..	..	2
Carpet Mills	4	1	3	..	..	..	..	1	..	..	..	..	..	9
Carriage Factories	..	1	2	..	1	..	..	1	..	..	2	..	..	7
Celluloid (Pyroxylin)	..	..	2	1	1	..	1	..	7	3	1	..	..	16
Cement and Plaster Works	..	..	..	..	1	..	..	..	..	..	..	..	..	1
Cereal Mills	..	2	1	..	..	..	..	..	..	1	..	..	..	4
Chemical and White Lead	1	1	..	..	..	..	..	..	..	2	..	..	..	4
Clothing Factories	3	..	1	..	..	..	2	1	..	..	..	..	..	7
Coffin Factories	..	..	..	1	..	..	..	..	..	..	..	..	..	1
Cooperage Plants	1	3	..	..	..	1	..	2	..	..	1	..	..	8
Cordage Works	2	3	1	..	..	..	..	2	..	..	..	..	1	9
Cork Factories	1	..	..	..	..	..	..	..	..	1	..	..	..	2
Cotton Mills	20	12	6	..	..	1	4	1	..	..	..	4	4	52
Cotton Warehouses	12	1	2	..	..	..	1	3	1	..	..	1	..	21
Cotton Seed Oil Mills	2	3	2	..	..	..	..	..	..	..	..	2	1	10
Cutlery and Hardware	1	..	..	..	..	..	..	..	..	..	..	..	..	1
Department Stores	4	3	..	..	..	..	..	1	..	..	2	..	1	11
Drug Houses	..	..	..	..	..	..	..	..	..	..	3	1	..	4
Dyeing and Bleaching	3	2	1	..	..	1	..	1	..	..	1	..	1	10
Electrical Appliances	1	..	1	..	..	..	..	..	..	..	..	..	1	3
Electric Light and Power Plants	..	1	..	..	..	..	..	..	..	..	..	..	..	1
Elevators, Grain	..	3	3	..	1	..	2	1	1	1	2	..	1	15
Excelsior Factories	..	..	1	..	..	..	..	..	..	..	..	..	..	1
Fertilizer Plants	1	..	..	..	1	..	..	..	..	..	..	..	..	2
Flour and Grist Mills	..	1	..	..	..	..	1	..	..	2	2	..	..	6
Foundries	5	1	1	..	..	..	..	..	..	1	..	..	..	8
Furniture Factories	9	12	2	3	..	..	2	8	6	..	2	..	..	44
Garage	1	..	..	..	..	..	..	1	..	..	..	..	..	2
Glass Works	1	1	..	..	..	..	..	..	..	..	..	..	2	4
Glue Factories	1	..	..	..	..	..	..	..	1	..	..	..	..	2
Hat, Fur	1	2	1	..	1	..	..	..	..	..	..	..	..	5
Jewelry Shops	2	1	..	1	..	..	..	..	..	..	..	..	..	4
Knitting, Cop Yarn	..	1	3	..	..	..	..	..	..	1	..	..	..	5
Knitting, Full Process	6	9	5	1	1	..	..	..	..	1	..	..	..	23
Laundries	1	..	..	..	..	..	..	1	..	..	..	..	..	2
Linseed Oil Works	..	..	..	..	..	..	..	..	..	1	..	..	..	1
Machine Shops	10	3	..	..	..	..	..	1	..	1	..	..	..	15
Match Factories	2	..	..	..	..	..	..	..	1	..	..	1	..	4
Mattress Factories	2	1	..	..	..	..	..	1	..	..	..	..	..	4
Mercantile	7	2	..	1	1	..	1	..	..	..	4	..	1	17
Metal Workers	11	10	2	..	..	..	1	..	..	1	2	1	2	30

Table No. 10—Concluded.

	Water shut off sprinklers.	Gen. defective equipment and unsprinklered portions.	Defective water supply or supplies.	Sprinkler system crippled due to freezing.	Slow operation of dry system or defective dry valve.	Slow or defective operation of high test heads.	Faulty building construction, concealed spaces, vertical openings.	Obstruction to distribution.	Hazard of occupancy too severe for average sprinkler equipment.	Explosion crippled sprinkler system.	Exposure or conflagration.	Miscellaneous.	Not classified.	Total.
Miscellaneous	2	3	1	..	1	..	2	..	1	..	3	1	..	14
Morocco Leather Shops	..	2	..	..	..	..	1	..	..	..	..	..	..	3
Musical Instrument Factories	..	3	..	..	..	..	..	..	..	..	1	..	..	4
Oilcloth and Linoleum Works	..	3	..	..	..	..	1	1	11	..	..	..	..	16
Packing House and Slaughter	..	1	1	..	..	..	..	..	..	..	..	..	..	2
Paint and Color Works	1	1	1	..	..	..	1	..	..	..	..	..	..	4
Paper Box and Papeterie	..	1	..	..	..	..	..	..	..	..	..	..	..	1
Paper Mills	8	16	4	2	..	2	2	..	1	1	2	4	3	45
Patent Leather Works	1	..	..	..	..	..	1	..	..	..	..	..	..	2
Picture Frame Factories	1	2	..	..	..	..	..	1	..	..	..	..	..	4
Potteries	..	..	..	1	..	..	..	..	..	1	..	..	..	2
Printing and Lithographing	4	4	1	..	..	..	..	..	..	..	3	1	..	13
Pulp, Miscellaneous	1	1	1	..	..	..	..	..	..	1	..	..	..	4
Pulp, Soda	2	1	..	..	..	..	..	..	..	..	..	..	..	3
Pulp, Sulphite	3	1	..	..	1	1	..	..	..	..	..	..	1	7
Rolling, Wire and Tube Works	..	..	..	..	..	..	..	..	..	..	..	..	1	1
Roofing Works	..	..	..	..	..	..	..	..	..	1	..	..	..	1
Rubber Reclaiming Works	..	..	..	..	..	..	1	..	..	..	..	..	..	1
Rubber Works	3	..	..	1	..	..	..	..	2	1	..	..	..	7
Saw and Planing Mills	8	7	1	..	3	1	6	2	1	..	4	1	2	36
Shoddy Mills	5	1	5	..	..	3	..	..	..	..	..	..	..	14
Silk Mills	1	1	..	..	..	..	..	..	..	1	..	..	..	3
Soap Manufacturing	..	1	..	..	..	..	..	..	..	..	..	..	..	1
Stamping and Sheet Metal Works	..	2	1	..	1	..	..	..	..	..	1	..	..	5
Starch and Glucose Mills	..	..	..	..	..	..	..	..	1	5	..	..	..	6
Tanneries	1	..	..	2	..	..	..	..	..	..	1	..	1	5
Tenant Manufacturing	7	5	2	..	1	..	1	1	..	..	5	..	1	23
Theatres	1	..	..	..	..	..	..	..	..	..	..	..	..	1
Tobacco Factories	1	1	..	..	..	..	..	..	..	..	1	..	..	3
Varnish Works	..	..	..	..	..	..	..	..	1	..	..	..	..	1
Wall Paper Factories	..	..	1	..	..	..	..	1	..	..	1	..	..	3
Warehouses	6	2	1	..	1	..	..	1	..	..	..	..	..	11
Waste and Batting Mills	1	3	1	..	..	1	..	1	..	..	..	1	..	8
Weaving Mills	1	1	1	1	..	..	..	..	..	..	..	..	..	4
Window Shade Factories	..	..	..	..	..	..	..	..	1	..	..	..	..	1
Woodworkers, Class A*	5	8	..	..	..	..	..	5	..	2	3	1	..	24
Woodworkers, Class B*	4	6	2	..	..	..	1	1	..	2	2	1	..	19
Woodworkers, Class C*	2	3	1	..	..	..	..	2	..	..	..	..	..	8
Woodworkers, Class D*	1	5	..	1	..	..	..	..	..	1	3	3	..	14
Woodworkers, Class E*	3	1	..	..	1	..	2	..	..	..	..	..	..	7
Woodworkers, Class F*	2	..	..	..	..	..	..	1	..	..	..	..	..	3
Woolen Mills	9	14	10	1	..	2	3	..	..	..	3	4	4	50
Wool Storehouses	..	2	..	..	..	..	..	..	..	..	..	..	..	2
Worsted Mills	2	3	2	1	..	..	..	..	..	..	..	2	2	12
Total Unsatisfactory Fires	212	191	80	18	18	14	38	48	37	34	62	30	31	813

*See detailed classification of woodworkers as given in note under Table No. 9.

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